3M Occupational Health & Environmental Safety Division

NoisePro™ Personal Noise Dosimeter

NoisePro™ User Manual

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NoisePro Series

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Warnings Concerning Safe Operation

Take care when changing batteries

WARNING: To reduce the risk of explosion, do not mix used batteries with unused batteries or mix batteries from different manufacturers.

WARNING: To prevent ignition of flammable or combustible atmospheres, no user serviceable parts inside. Repair should be done by authorized service personnel only.

WARNING: To reduce the risk of ignition of a flammable or explosive atmosphere, batteries must be changed only in a location known to be non-hazardous.

Do not substitute components

WARNING: To reduce the risk of ignition of a flammable or explosive atmosphere, substitution of components may impair intrinsic safety.

Accessories

The following parts are externally attached to the ***NoisePro*** instrument.

053-867	Microphone assembly consisting of a Type 2, 0.335 in. (8.5 mm) O.D., shoulder-mounted microphone, cable and LEMO connector.
053-885	Optional boom microphone assembly, consisting of a Type 2, 0.335 in. (8.5 mm) O.D. microphone and rigid boom that mates with a LEMO connector.
053-862	Optional belt clip assembly that contains a vibrating motor.

BATTERIES AND STORAGE

To reduce the risk of "AA" Alkaline batteries from leaking, it is recommended to:

- Remove the batteries from the housing whenever the NoisePro is stored for approximately 2 to 3 weeks or longer.
- Replace the batteries when LOBAT message appears on the display of the NoisePro.
- For more information on replacing batteries or recommended battery types, please refer to Chapter 10, "Replacing batteries" and "Approved batteries".

Table of Contents

Trademarks ii
Approvals ii
Copyright ii
Updates ii
Warnings Concerning Safe Operation iii
Take care when changing batteries iii
Do not substitute components iii
Accessories iii
List of Figures xi
List of Tables xii

Chapter 1: Introduction 1
Noise dosimetry 1
Wide dynamic range of sound 1
Standards 1
NoisePro models 1
About studies and sessions 2
Logging 2
Area monitoring 2
Session time line 3
Run Time 4
Use the cover 4
NoisePro case and controls 5

Chapter 2: First time use 7
Assembling 7
DLX-1 7
All other NoisePro models 8
NoisePro keys 8
Powering on/off 9
Verifying battery power 9
Establishing operating conditions 9

Displays and the clock 9
Selecting logging options (DLX models only) 10
Choosing dosimeter setups 10
Calibrating 10
Preparing to measure 11
Reset operation 11
Attach the windscreen 11
Microphone positioning 11
Measuring noise levels 13
Running studies 13
Viewing results 13
Closing sessions 14
A few words about displays 14

Chapter 3: Calibrations 15
Field calibrator 15
Performing a field calibration 15
Preliminary steps 15
Assemble 16
Calibration display 17

Chapter 4: General setup 19
Setup display 19
Auto-Run 20
Time-Date 25
Prj Time 25
Logging 26
Comm Set 28
Language 28
Display 29
Vibrating belt clip 30

Chapter 5: Configuring dosimeters 33
What is a dosimeter setup? 33
Pre-defined setups 33
User-defined setups 34

Dosimeter setup displays 34
Dosimeter Options display 35
View Setup display 36
Parameter Settings display 36
Changing range and weighting settings 37
Assigning a setup to a dosimeter 37
Conflict resolution 38

Chapter 6: Examining results 39
Selecting the source 39
Viewing current results 39
Reviewing previous results 40
Results display 41
Display characteristics 42
SLM measurements 44
Interpreted summaries 44

Chapter 7: Security settings 47
Secure Run Mode 47
Disable Secure Run Mode 48
Secure Setup Mode 49
Disable Secure Setup Mode 49

Chapter 8: Communications 51
Purposes of communication 51
Using QuestSuite Professional 51
Shuttling results 51
Generating reports 51
Hardware setup 51
Software operations 53
Comm display 53
Print display 54
Anatomy of a NoisePro report 56

Chapter 9: Application topics 61
Adding and subtracting levels 61
Background noise 61

Combining noise sources 62
Noise Floor 63

Chapter 10: Maintenance 65
Approved batteries 65
Replacing batteries 65
Exchanging belt clips 67

Chapter 11: Technical support 69
Troubleshooting 69
Blank display 69
General calibration problems 69
Pre-calibration value not saved 69
Post-calibration discrepancy 69
Unit is erratic 70
Clock settings lost 70
Belt clip vibrator not working 70
Belt clip vibrator won't turn off 70
Communications not working 70
Mic error 70
Battery error (PFR restore) 70
Factory service 71

Appendix A: Glossary 73
Basic Descriptors 73
Criterion Level (CL) 73
Criterion Time 73
Decibel (dB) 73
Dose 74
Exceedence Levels 74
Exchange Rate (ER) 74
Hearing Conservation (HC) 75
Hertz (Hz) 75
IEC/ISO Descriptors 75
LAVG 76
LDN 77

LEP,d 77
LEQ 77
Max Level 77
Min Level 77
Peak Level 77
Permissible Exposure Limit (PEL) 78
Response 78
Sound Exposure Level (SEL) 79
Threshold 80
Time Weighted Average (TWA) 80
Upper Limit (UL) 81
Weighting 81

Appendix B: Measurement equations 83

Appendix C: Microphone 87
Frequency response 87
Class 1 microphone 87
Class 2, cable-mounted microphone 90
Class 2, boom-mounted microphone 92

Appendix D: Specifications 95
Standards 95
User interface 95
Measurement Ranges 95
Measurement settings 95
Measurement resolution 96
Calibrations 96
Logging (DL and DLX models only) 97
Communications 97
Special functions 97
Environmental factors 98
Electrical characteristics 98
Mechanical characteristics 99
Approvals 99
Replacement Parts 99

Optional accessories 100
Adapter. 100
Calibrators 100
Tripods 100
Other 100

Appendix E: Block diagram 101

Appendix F: Quest policies 103
Service 103
International customers 103
United States customers only. 103
Warranty 104

Index 105

List of Figures

1–1 Session time line 3
2–1 Shoulder-mounted microphone 12
2–2 Start display and softkeys 14
3–1 Calibration orientations and assembly 16
3–2 Calibration display 17
3–3 Calibration Save display 18
4–1 DLX model Setup display 19
4–2 Auto-Run display 20
4–3 DLX Date Setup display 21
4–4 Timed Run Setup display 22
4–5 Days of Week Setup display 23
4–6 Logging Setup display 26
4–7 DL and DLX Vibration Setup display 31
5–1 Working with dosimeter setups (DLX displays shown) 35
6–1 Source Selection display 40
6–2 Results display 41
6–3 Summary display 44
6–4 Alert Levels (AL 1 & 2) 45
7–1 Security Control display 47
7–2 Locked Run display 48
8–1 Infrared cable connections 52
8–2 Comm display 53
8–3 DLX Print display 54
8–4 Header section 57
8–5 Session section 58
8–6 Study section 59
8–7 Logging section 60
9–1 Background noise correction chart 62
9–2 Combining measurements chart 63
10–1 Battery replacement 66
10–2 Belt clip assembly 67

A–1 Slow response to a tone burst 78
A–2 Fast response to a tone burst 79
A–3 NoisePro weighting curves 82
C–1 Class 1, free field, 0o, no windscreen 88
C–2 Class 1, free field, 90o, no windscreen 88
C–3 Class 1, random incidence, no windscreen 89
C–4 Class 1, random incidence, windscreen 89
C–5 Class 2, free field, 0o, no windscreen 90
C–6 Class 2, free field, 90o, no windscreen 90
C–7 Class 2, random incidence, no windscreen 91
C–8 Class 2, random incidence, windscreen 91
C–9 Class 2, boom, free field, 0o, no windscreen 92
C–10 Class 2, boom, free field, 90o, no windscreen 92
C–11 Class 2, boom, random incidence, no windscreen 93
C–12 Class 2, boom, random incidence, windscreen 93
E–1 NoisePro block diagram 101

List of Tables

4–1 Explanation of logging options 26
5–1 Parametric settings for pre-defined setups 34
6–1 Setups, Alert Levels and tagged compliance indicators 46
A–1 Basic and IEC/ISO descriptors compared 76
B–1 Variables used in the equations 85

CHAPTER 1

Introduction

Noise dosimetry is all about measuring sound and protecting hearing. To do that well, a dosimeter must provide comprehensive information under varying conditions, in multiple locations and with user settings. It should also be easy to use.

To demonstrate the ability of ***NoisePro*** to function as a powerful yet user-friendly tool, this introduction is intended to get you going quickly. First we'll briefly cover some information about noise dosimetry and then demonstrate how easy it is to put ***NoisePro*** to work, right out of the box.

Noise dosimetry

Wide dynamic range of sound

Sound energy is commonly expressed in decibels (dB) which relates one energy level to a second energy level on a logarithmic scale. For instance, if the noise in a room is 50 dB (common in a busy office), workers in the area are exposed to a noise level that is 100,000 times as loud as they can barely hear. At a noise regulation level of 90 dB, their noise exposure is one billion times the level at the threshold of hearing. The range between the least detectable sound and the peak sound in an environment is called the sound's dynamic range.

Standards

Many organizations have studied the detrimental effect of high sound levels on hearing. As a result, standards have been developed to ensure hearing safety. In the United States, the Occupational Safety and Health Administration (OSHA), the Mine Safety and Health Administration (MSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH) have all set limits on how much environmental noise is permissible. These limits are commonly cited in workplace standards and in the design of noise measurement devices.

NoisePro models

This manual is used for all ***NoisePro*** models. You can identify differences between the models in Appendix D , "Specifications." Differences in setup and operation between the models are identified and explained throughout the manual.

About studies and sessions

You can monitor sound levels without recording them, but in most cases, you will store your measurements for separate evaluation. Recordings are performed in studies, and studies are grouped together in a session. A typical session consists of the recording of multiple studies in a work day, where the studies are separated by paused periods that allow time for work breaks and the lunch period.

If you are using a ***DLX*** model, you can group studies in separate sessions and store as many as 100 sessions at one time in the instrument's memory. For the other ***NoisePro*** models, all of the studies stored in memory are part of the same session.

Session results are derived values based on the results for all studies in the session. For example, the start and stop times of a session are determined by the first and last studies in the session. The dose for a session is the accumulation of the dose results for all studies in the session. The maximum sound level for the session is the highest value of all the maximum sound levels obtained during the studies in the session. All measurements obtained for a study have their counterparts in session results.

Logging

In addition to making overall measurements, the ***NoisePro DL*** and ***DLX*** models save results periodically in a process known as data logging. Logged results are for a particular logging interval and don't depend upon other logged values or overall values for the study. The ***DL*** logs measurements automatically and needs no setup. For the ***DLX*** models, you can control what gets logged and the logging interval, and you can vary logging conditions in different sessions.

Area monitoring

With its standard, shoulder-mounted microphone and dosimetry interpretations ("Interpreted summaries" on page 44), ***NoisePro*** is optimized to make dosimetry measurements. It can also perform area monitoring, whether accumulating dosimetry information or not. Using ***NoisePro*** for area monitoring is equivalent to putting it to work as a sound level meter.

Sound level meters require a different type of microphone attachment. While a shoulder-mounted microphone is best when monitoring for personal noise exposure, a rigid mounting is better for area monitoring. For that reason, Quest makes a boom-

mounted microphone as an optional attachment. For information about installing the boom microphone, see “Assembling” on page 7.

You can perform area monitoring without recording data because sound levels are being measured even when no study is being performed (“SLM measurements” on page 44). But you can also record the results if you wish using all the features of the ***NoisePro*** for dosimetry, including running studies automatically and communicating the results to external devices.

Session time line

Figure 1–1 illustrates a recording period in which two studies are conducted and logging performed. For a ***DLX***, this illustration represents the first of possibly multiple sessions recorded into memory because it is preceded by a Reset. For the ***DL*** and ***DLX*** models, the short dashed lines across the waveform indicate that logging is occurring.

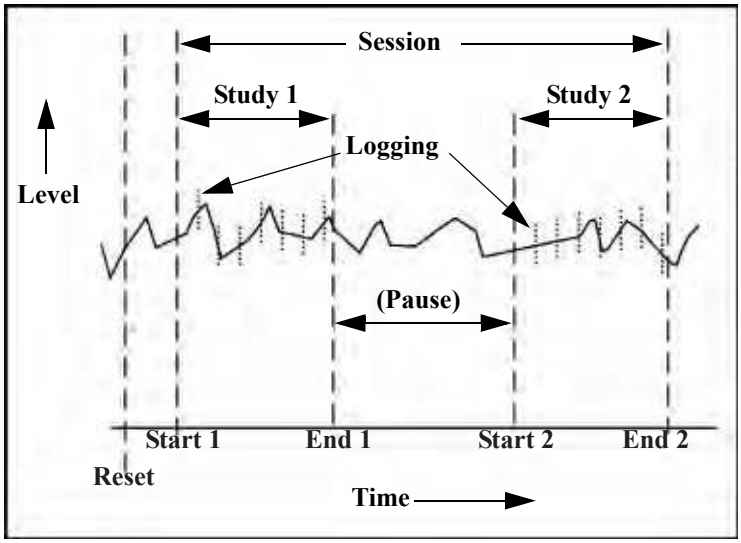


Figure 1–1: Session time line

Explanation of features

Reset	Clears memory. If using a ***DLX*** model, the session counter is reset to 1.
Start 1	Opens the session and starts Study 1. This event marks the beginning of the session run time.
End 1	Ends Study 1 and begins a pause in the session. The session run time clock stops.
Pause	No data recording, but sound level monitoring could still take place.
Start 2	Begins Study 2. The session run time clock resumes.
End 2	Ends Study 2. The session run time clock stops again.

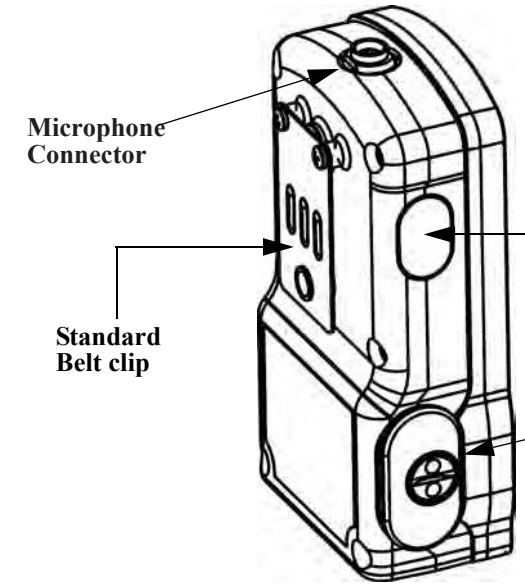
Run Time

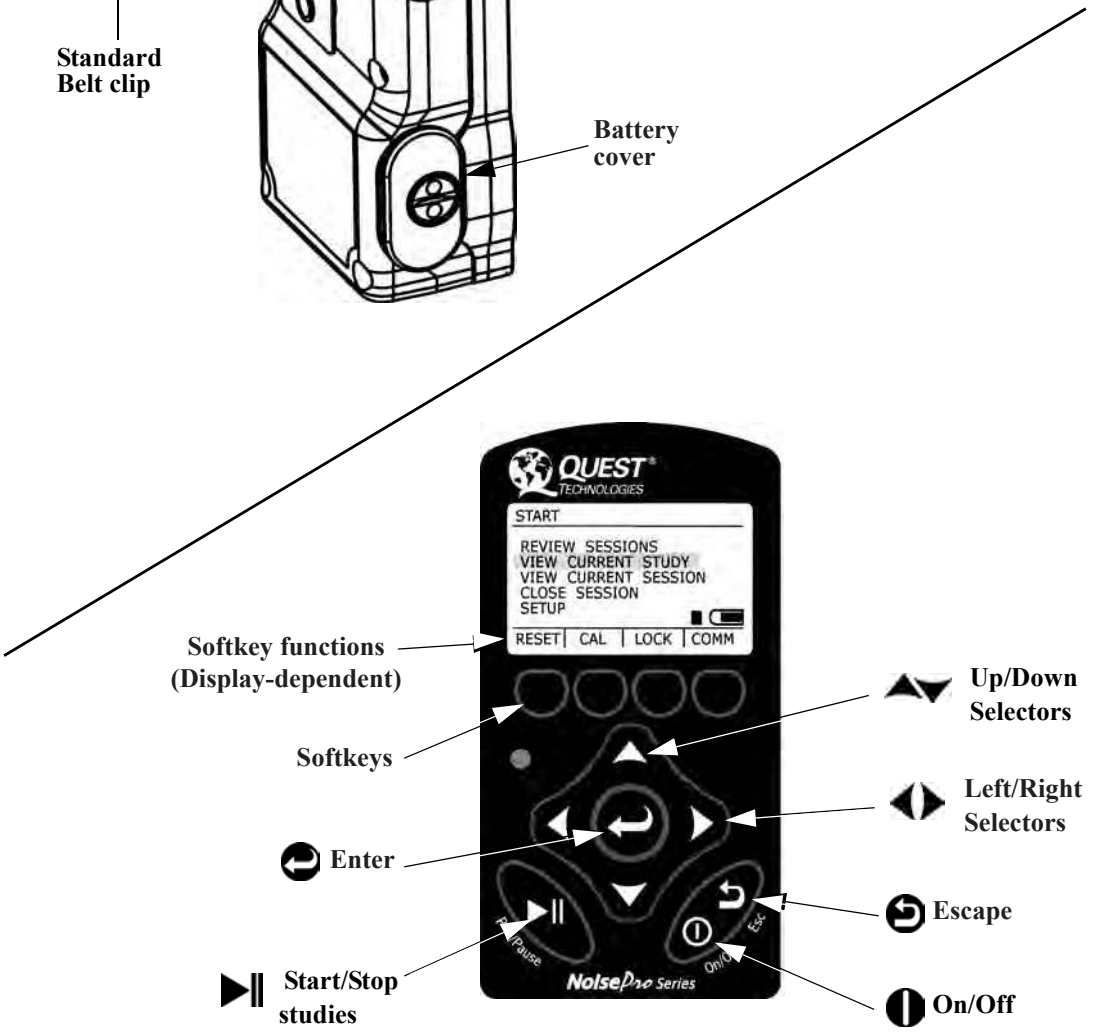
The time period of a study is the study's run time. The time period of a session is the sum of the run times of the individual studies in the session. The session run time begins at the beginning of the first study and ends at the end of the last study in the session, with pause times omitted.

Use the cover

Remember to replace ***NoisePro***'s cover when you don't need to get at the controls. It helps even when you're running an Auto-Run study. The cover guards against damage and prevents the unintentional operation of the instrument.

NoisePro case and controls





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CHAPTER 2

First time use

NoisePro is available in several models, including one Class/Type 1 model and several Class/Type 2 models (referenced later simply as Class 1 and Class 2). For an orientation to the case and controls features discussed in this chapter, see "NoisePro case and controls," on the facing page.

Assembling

If your instrument is a ***NoisePro DLX-1***, you received a microphone cable assembly and separate microphone. For all other instruments, you received an integrated cable-mounted microphone, but you may be using the optional boom-mounted microphone.

DLX-1

Your Class/Type 1 microphone and an optional Random Incidence Corrector are provided in a separate container that also includes additional information and instructions. For information about using the corrector, see "SLM measurements" on page 12.

NOTE: This microphone's grid cap is removable. Do not remove it and do not touch the diaphragm underneath.

Class 1 microphone

Position the microphone cartridge over the cable connector and screw to tighten. In accordance with the Class 1 microphone's packaging instructions, keep the microphone's center terminal from contacting first. After attaching the microphone to the cable, follow the instructions under "Cable microphone" on page 8 to connect the cable to the instrument.

Random Incidence Corrector

The purpose of this device is to improve the high frequency response of the Class 1 microphone under random incidence sound source conditions. To apply it, push over the tip of the microphone until the microphone seats against a lip in the corrector (approximately 1 mm from the end).

Frequency response curves for the microphone without the corrector are given under "Class 1 microphone" on page 87. Response curves with the corrector attached are provided with the Class 1 microphone.

All other NoisePro models

Cable microphone

Attach by connecting the cable to the instrument.

➤ **To install**

1. Rotate the cable connector to align it properly with the Microphone Connector. There is only one way that it fits.
2. Push it straight in. The connectors automatically latch together.

➤ **To remove**

1. Grab the ring in the middle of the cable connector.
2. Pull it straight out. The ring slides to unlatch the connectors.

Boom microphone

The boom microphone is an optional type 2 microphone assembly.

➤ **To install**

1. Line up the boom connector with the Microphone Connector. There is only one way that it fits.
2. Plug in the boom connector.
3. Screw to tighten by rotating the boom connector's knurled ring clockwise.

➤ **To remove**

1. Unscrew to release the boom connector's knurled ring.
2. Pull the boom connector straight out of the Microphone Connector.

NoisePro keys

Many of the procedures in this manual identify keys by the images that appear on the keys of the ***NoisePro*** keypad, for example for the power **On/Off** key. See "NoisePro case and controls" on page 6 for the locations of these keys.

Powering on/off

The key shown at the right has multiple uses, including powering the instrument on, powering it off and backing up through displays during instrument operation. That key is shown at right.

Press ◐ to power ***NoisePro*** on. To power it off, press ◐ again and keep depressed during a countdown. The ↩ symbol is, in reality, for the same key but denotes the key's escape function (backing up to a previous display) that you use to move backward along a display path.

NOTE: You will not be able to power ***NoisePro*** off while a study is running.

Verifying battery power

With the instrument on, look in the lower right corner of the display for a symbol like the one shown at the right. The dark bar in this icon shortens to the right as battery power decreases.

When battery power gets down to an estimated eight hours of run time, the battery icon is replaced by the word, **LOBAT**. When **LOBAT** appears, consider replacing the AA batteries to ensure enough power to complete your studies ("Replacing batteries" on page 65).

Establishing operating conditions

NoisePro is shipped with default settings that enable you to get started right out of the box, but you may want to changes some of the settings.

Displays and the clock

You may want to customize display characteristics and verify, or change, clock settings before running studies.

➤ **To work in Setup displays**

1. In the Start display, press ▲▼ until **SETUP** is highlighted.
2. Press ↵. The Setup display appears.

3. Press ▲▼ to make your selection.
   - Select **TIME-DATE** to set the clock.
   - Select **DISPLAY** to control backlighting and pick descriptors.
4. For details on working in these and other setup displays, see “Setup display” on page 19.
5. When finished changing settings in any Setup display, press ↩ to escape to the previous display (more than once to keep backing up to previous displays).

Selecting logging options (DLX models only)

In the ***DLX***, you can choose logging parameters such as what gets logged and at what rate. See “Logging” on page 26 to learn about these procedures.

Choosing dosimeter setups

All ***NoisePro*** models operate with multiple dosimeters at once, and each dosimeter can be assigned a setup from among the nine setups available. For information about these setups, including how to view them, change them and assign them to the dosimeters, see Chapter 4, “Configuring dosimeters.”

Calibrating

It’s wise to calibrate both before and after each study. The instrument will display pre-calibration and post-calibration information for your field review plus store it with the data for later review and analysis (Chapter 2, “Calibrations,”).

Preparing to measure

Reset session memory, attach the windscreen and mount the microphone and case in accordance with your purposes.

Reset operation

A Reset removes all data from session memory, so make sure you no longer need that stored data before resetting.

You must be in the Start display to perform a Reset. If in any other display, complete whatever task you're doing in that display and press ↩ one or more times to get back to the Start display. In the Start display, press the **RESET** softkey and hold until told in the display that all studies have been cleared.

Attach the windscreen

Use the ***NoisePro*** windscreen for all measurements. A windscreen reduces errors due to wind turbulence and helps prevent microphone damage. After calibrating, push the windscreen over the tip of the microphone. It stretches for a snug fit.

Microphone positioning

You can use ***NoisePro*** for both dosimetry (personal monitoring) and sound level meter (SLM) measurements, but microphone positioning should be different for these two conditions.

Dosimetry

Clip the microphone to your shirt or collar (Figure 2–1) as high on the shoulder as possible and away from the neck. If the noise seems to come from one direction, place it on the shoulder closest to the noise source. During monitoring, keep clothing from coming into contact with the windscreen to avoid erroneous noise artifacts. If you have the optional microphone clips, use them to keep the cable from disturbing the microphone position ((“Optional accessories” on page 100).

NOTE: To use the ***DLX-1*** model for dosimetry, attach the Random Incidence Corrector furnished with the Class 1 microphone.

Figure 2–1: Shoulder-mounted microphone

Clip the instrument's belt clip over your belt. If using the optional vibrating belt clip (or need to go back to the standard belt clip) see "Exchanging belt clips" on page 67 to install the appropriate belt clip for your purposes.

SLM measurements

You should do your best to minimize sound reflections, diffractions and absorptions caused by nearby objects, including the operator (free field condition). Avoid placement near a wall or in a corner.When doing free field monitoring, do not use the Class 1 microphone's Random Incidence Corrector. If reflections, diffractions or absorptions from nearby objects are present, use the corrector for random incidence monitoring.

Whenever possible, attach the instrument to a tripod. Quest offers two types of tripods as optional equipment ("Tripods" on page 100). Mount on the tripod by screwing the tripod mounting bolt to the 1/4-20 threaded fitting in the instrument's belt clip.

Orient the microphone depending upon whether you are doing free field or random incidence monitoring.

- **Free field (*DLX-1* only)**~ Point the microphone directly at the sound source.
- **Random incidence** ~ Angle the microphone upward at approximately 70^{o} with respect to the sound source. (Applicable to all Class 2 models and the Class 1 model with the Random Incidence Corrector applied.)

Measuring noise levels

Once the instrument is on, you can start and stop studies with a single key. During or after a study, you can open the Results display to examine a wide variety of level, average and dose measurements obtained with multiple dosimeter setups.

Running studies

Start and stop studies using the key shown at the right. When a study is running, a Run Icon (▶)appears just to the left of the battery icon at the lower right corner of the display. When the session is paused, a Pause Icon (‖) replaces the Run Icon. After a Reset that clears memory, a Session Closed Icon (■) appears in that location.

Viewing results

Examine noise measurements and other information in the Results display (“Results display” on page 41).

➤ **To view results**

1. In the Start display, press ▲▼ to highlight **VIEW CURRENT STUDIES**.
2. Press ↵. The Results display appears (Figure 6–2).
   - Press the **LEVEL**, **AVG**, **DOSE** and **SUMRY** softkeys to cycle through measurements and a measurement summary.
   - Press ◀▶ to switch between the instrument’s dosimeters and view measurement results for each dosimeter.
3. Press ↩ to return to Start display.

Closing sessions

[DLX models only]. You can segregate studies into separate sessions by closing the current session. A new session will open when you start the next study.

➤ **To close a session**

1. In the Start display, press ▲▼ until **CLOSE SESSION** is highlighted.
2. Press ↵. The session closes immediately.

A few words about displays

The ***NoisePro*** starts in the Start display, which is shown below. From there you can branch to other displays, and in some cases to even more displays in a cascading fashion.

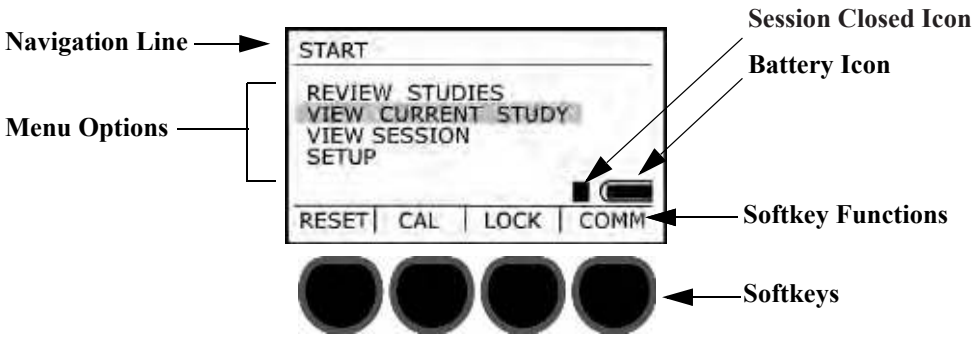

Figure 2–2: Start display and softkeys

Most displays contain Menu Options, a Navigation Line at the top and Softkey Functions along the bottom. Select a menu option with the ▲▼ keys. The Navigation Line tells you what displays preceded the current display along a display path. To get back from any display to the previous display in the cascade, the general rule is to press ↩ (In some cases you're taken back automatically.) The Softkey Functions identify the purpose of the softkeys that are located directly below the display. Softkey functions are generally different for different displays.

CHAPTER 3

Calibrations

Noise measurements are only as good as the calibration of the measuring instrument. To assure yourself that your ***NoisePro*** dosimeter is functioning within normal tolerance limits, return it to the factory periodically for a factory recalibration ("Factory service" on page 71).

This chapter explains how you can verify measurement calibration as part of your normal operating procedures.

Field calibrator

The Quest calibrator is a portable device emitting sound at a fixed frequency and sound level. For some calibrators, the signal frequency and sound level can be selected. For all calibrators, the indicated frequency and sound level is specified on the calibrator.

NOTE: Calibrators can be affected by changes in altitude and barometric pressure, and sometimes corrections are necessary. See your calibrator's user manual.

Calibrate the calibrator

The conformance of a field calibrator to its specifications should be periodically checked as well. To have a Quest calibrator checked, return it to a factory-authorized service center ("Factory service" on page 71).

Performing a field calibration

Preliminary steps

- Stop the current study. You cannot calibrate while a study is running.
- If the windscreen is on the microphone, remove it.
- The instrument must be ON with the microphone connected to it.
- Check the instrument battery indicator. If **LOBAT** is showing, replace the instrument's batteries before proceeding ("Replacing batteries" on page 65).

- Check the calibrator battery indicator. If the **LOBAT** indicator is ON, see the calibrator's user manual to replace the calibrator batteries before proceeding.
- If the calibrator has a selectable frequency setting, set it to 1000 Hz.

Assemble

Refer to Figure 3–1 for either the cable-mounted or boom-mounted (type 2 only) microphone. Type 1 and type 2 microphones require different adapters.

➤ **To prepare to calibrate**

1. Turn the calibrator ON.
2. Place the adaptor on the microphone.
3. Orient for either the cable-mounted or boom-mounted microphone as illustrated in Figure 3–1, then press the adapter into the calibrator.

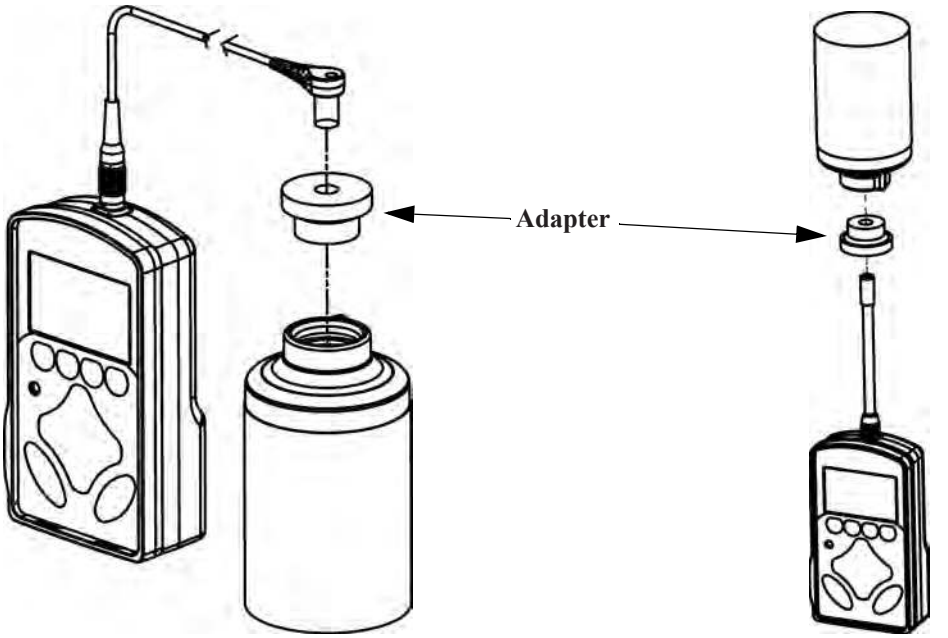

Figure 3–1: Calibration orientations and assembly

Calibration display

Use the Calibration display to view and save calibrations (Figure 3–2).

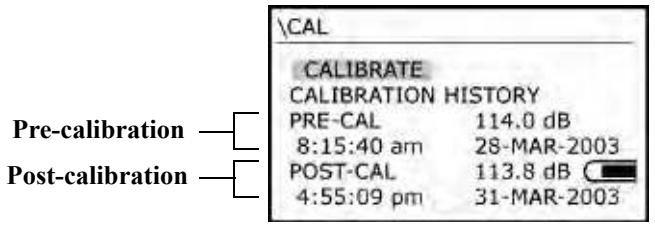

Figure 3–2: Calibration display

The Calibration display always shows the latest Pre-and Post-calibration results. Times are reported according to either the 12-hour or the 24-hour clock convention, according to your selection ("Time-Date" on page 25).

If you're using a NoisePro or NoisePro DL, the Pre-calibration information applies to a calibration done with a cleared memory (after a Reset). For a ***DLX*** model, you can also save a Pre-calibration value between sessions. The Post-calibration information applies to a calibration done after any study in the session and is stored with the study that it follows. When two or more calibrations are done after a study, only the last one is saved.

When saving a Pre-calibration value, you may adjust it so that it agrees with the calibrator's output level. A Post-calibration value can only be saved as is—you cannot adjust it. The Post-calibration value indicates whether there was any change in the instrument that affected its calibration during the study.

Saving a calibration

A Pre-calibration is saved only if the instrument passes a test of the calibration. A Post-calibration is saved automatically without being tested. For both Pre- and Post-calibration measurements, you should verify the results in the Calibration display.

➤ **To save a Pre-calibration**

1. Prepare the equipment ("Assemble" on page 16).
2. Press the **CAL** softkey in the Start display. The Calibration display appears (Figure 3–2).

3. **CALIBRATE** is highlighted in the display. Press ↵. The Calibration Save display appears (Figure 3–3). The intended Calibration Assignment shows in the Navigation Line.

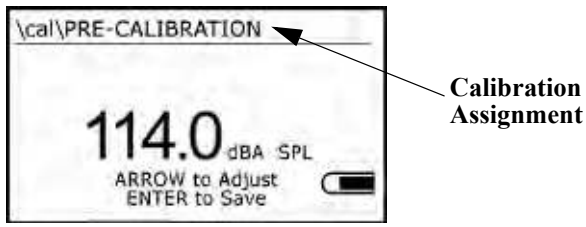

Figure 3–3: Calibration Save display

4. Press ▲▼ to adjust the value equal to the calibrator's labeled output level.
5. Press ↵. A test progress bar appears. At the end of the test, either **PASS** or **FAIL** briefly appears above the bar, then the Calibration display reappears.
   - **Pass** ~ The new calibration results are posted in the Pre-calibration section of the Calibration display.
   - **Fail** ~ The new calibration results are not saved. The previous Pre-calibration results remain in the Calibration display. For assistance when calibration fails, see "Troubleshooting" on page 69

➤ **To save a Post-calibration**

1. Repeat steps 1-3 under "To save a Pre-calibration," above.
2. Skip step 4 (You cannot adjust the Post-calibration value.)
3. Press ↵. The Calibration display appears with the new calibration posted in the Post-calibration area. If there is a substantial discrepancy between the Pre-calibration and Post-calibration results, see "Troubleshooting" on page 69

CHAPTER 4

General setup

NoisePro comes ready for immediate use with default settings, but you can change many settings to configure it for your individual purposes. For example, you should check the time to verify that it matches your local time ("Time-Date" on page 25).

This chapter explains the setup procedures that are available as menu options in the Setup display. There are also setup procedures for individual dosimeters (Chapter 4, "Configuring dosimeters.")

NOTE: User-defined settings may only be changed when a study is not running. Also, you cannot enter any setup display when security setup is enabled unless you know the setup code ("Secure Setup Mode" on page 49).

Setup display

The Setup display is an option on the Start menu.

➤ **To get to the Setup display**

1. In the Start display, press ▲▼ to highlight Setup. (If not already in the Start display, press ↩ one or more times to get there. You may need to complete an operation in your current display before using ↩.)
2. Press ↵. The Setup display appears (Figure 4–1).

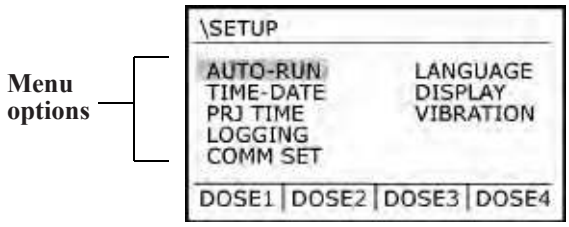

Figure 4–1: ***DLX*** model Setup display

Auto-Run

In addition to running studies manually as explained under "Running studies" on page 13, you can operate in several Auto-Run modes.

In the Date and Days of Week modes, ***NoisePro*** is fully automatic. After setting up and enabling one of these modes, switch the power off, position the microphone and then walk away. When the run date and time arrives, ***NoisePro*** turns itself on, runs the study, then turns itself off again.

Timed Run is a semi-automatic mode. After setting up and enabling that mode, start a study by pressing ▶‖. When the preset run time arrives, ***NoisePro*** stops the study automatically.

Choose an Auto-Run mode in the Auto-Run display. Select **AUTO-RUN** in the Setup display, then press ↵. The Auto-Run display appears (Figure 4–2).

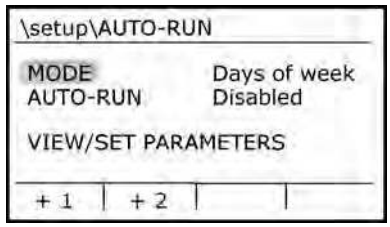

Figure 4–2: Auto-Run display

Date mode

For all models, you can specify the start and run times for the date selected. For a ***DLX***, you can select up to four dates.

NOTE: The ***NoisePro*** Auto-Run feature operates on a one-year calendar. In Auto-Run Date mode, you cannot select a date more than 364 days ahead.

➤ **To set in Date mode**

1. If **MODE** is not selected in the Auto-Run display, cursor to highlight it (Figure 4–2).
2. Press ↵ once or twice until **DATE** appears on the right.
3. If you're using a ***DLX*** model, press any of the numbered Date/Time softkeys. For all other models, press the softkey labeled 1. If the key label is preceded by a negative sign (disabled), press it again to enable that selection. The Date Setup display appears with the Auto-Run Banner highlighted (Figure 4–3).

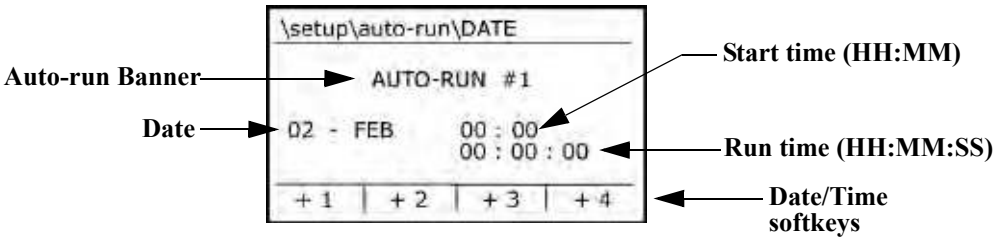

Figure 4–3: ***DLX*** Date Setup display

4. Press ↵ to highlight the first date field (day of the month).
5. Press ▲▼, to select a day, then press ↵ to highlight the next field in sequence.
6. Repeat step 5 for each field in sequence until the highlight returns to the Auto-Run Banner at the top.
7. Options at this point:
   - **Repeat** ~ If you want to change any of the settings you just made, press ↵ and repeat steps 5–7 of this procedure.
   - **Another date** ~ For a ***DLX*** model, if you want to program an additional date, press a different Date/Time softkey, then repeat steps 4–7. If that selection is preceded by a negative sign, enable it by pressing the softkey again.
   - **Quit** ~ Press ↩ to escape from this display.

NOTE: You can only escape from the display when the Auto-Run Banner is highlighted.

8. To activate this Auto-Run setup, see "Enable/disable Auto-Run" on page 24.

Timed Run mode

Set a time in Timed Run mode when you want to start a study manually but end it automatically.

➤ **To set in Timed Run mode**

1. In the Auto-Run display, cursor to highlight **MODE** (Figure 4–2).
2. Press ↵ once or twice until **TIMED RUN** appears on the right.
3. Press the Time softkey. The Timed Run Setup display appears (Figure 4–3).

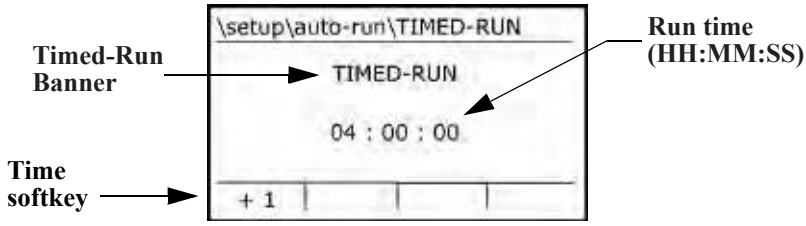

Figure 4–4: Timed Run Setup display

4. The Timed-Run Banner is highlighted. If you see **OFF** below the banner, enable the function by pressing the softkey again.
5. Press ↵ to highlight the first of three time fields (HH:MM:SS).
6. Press ▲▼, to modify, then press ↵ to highlight the next field.
7. Repeat steps 5–6 for the seconds field. The highlighting will return to the Timed-Run Banner at the top.
8. Press ↩ to escape the display.

NOTE: You can only escape from the display when the Timed-Run Banner is highlighted.

9. To activate this Auto-Run setup, see "Enable/disable Auto-Run" on page 24.

Days of Week mode

Set for regular daily studies. For each of two setups, you can select the days of the week on which you want to run one or two studies. You can select any number of days, any time of the day and run times up to 100 hours. When you enable Auto-Run after choosing the Days of Week mode, ***NoisePro*** starts and stops studies according to your settings for as long as it can record or until you disable it.

➤ **To set in Days of Week mode**

1. In the Auto-Run display, cursor to highlight **MODE** (Figure 4–2).
2. Press ↵ once or twice until **DAYS OF WEEK** appears at the right.
3. Press one of the Days/Time softkeys. The Days of Week Setup display appears(Figure 4–5). Either **#1** or **#2** is highlighted, depending upon which softkey you pressed.
4. If **OFF** appears opposite your choice, press the same softkey again to enable that option.

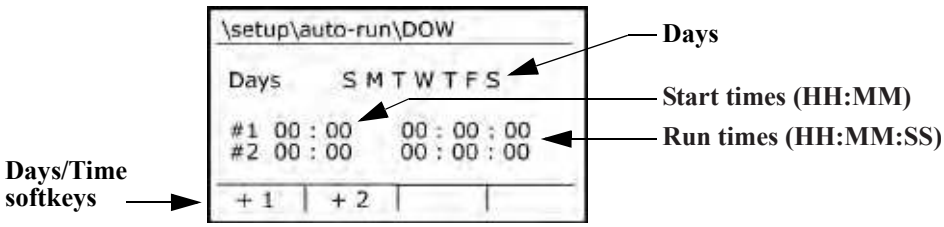

Figure 4–5: Days of Week Setup display

5. Press ↵ to move the highlighting to the first time field (hours).
6. Press ▲▼, to modify, then press ↵ to highlight the next time field in sequence. Figure 4–5 identifies the time fields according to hours (HH), minutes (MM) and seconds (SS).
7. Repeat step 6 for each time field in sequence until the highlighting moves to the other Days/Time selection (**#1** or **#2**).
8. Options at this point:
   - **Repeat** ~ If you want to change any of the time settings you just made, press ▲▼ to move back to the **#1** or **#2** time selection, then press ↵ and repeat steps 6–8 of this procedure.

- **Another time** ~If you want to program the second time, press and repeat steps 6–8 of this procedure. If the second Days/Time selection is disabled, enable it by pressing the softkey for that selection.
- **Quit** ~ Skip to step 13 below.
- **Select days** ~ Continue below.

9. If the highlighting is not on **DAYS**, press to move it there.
10. Press . The highlighting moves to a day choice.
11. Press to toggle the day, then press to move to the next day. If the letter is showing, that day is enabled. If a dash (–) is showing, the day is disabled.
12. Repeat step 11 for all the days of the week.
13. If done with the setup, press to escape the display.

NOTE: You can only escape the display when **#1**, **#2** or **DAYS** is highlighted.

14. To activate this Auto-Run setup, see "Enable/disable Auto-Run," below.

Enable/disable Auto-Run

Auto-Run is disabled by default. You must enable it to run studies according to the mode, date and time settings you previously selected. When you enable and power down, the time and date when the instrument will turn itself on will be displayed.

NOTE: If you set multiple auto-runs, make sure that you set the start time of each to occur no earlier than 2 minutes after the end of the previous auto-run.

➤ **To enable/disable Auto-Run**

1. In the Auto-Run Setup display, cursor to highlight **AUTO-RUN**.
2. Press to toggle the setting to **Enabled** or **Disabled.**
3. Press to escape the display.
4. [**Date** or **Days of Week** mode only] Switch off ***NoisePro*** power. You must switch ***NoisePro*** off for these modes to operate.

Time-Date

Select this display to change clock settings, for example to change the hour to adapt to a time zone or daylight savings time difference. In addition to setting the time and date, you can specify whether your display reads in the 12-hour or 24-hour format.

➤ **To change settings**

1. In the Time-Date display, press ▲▼ to select **TIME**, **DISPLAY** or **DATE**.
2. Press ↵ to advance the cursor into the data field.
3. Press ▲▼ to modify the setting.
4. Press ↵ to advance the cursor, either into the selection's next data field or to a different selection.
5. Repeat all steps above to change other settings in this display.
6. Press ↩ to escape the display.

NOTE: You can only escape the display when **TIME**, **DISPLAY** or **DATE** is highlighted.

Prj Time

Set a Projected Time when you want to calculate dosages for a time that is different than the Run Time. This setting applies to all active dosimeters (global setting).

➤ **To set Projected Time**

1. In the Prj Time display, press ↵ to highlight the setting.
2. Press ▲▼ to select a new setting
3. Press ↵ to change it.
4. Press ↩ to escape the display.

Logging

If you're using the ***DLX***, the Logging Setup display, shown in Figure 4–6, allows you to set the logging rate and two logging thresholds. You can choose which measurements are logged by selecting **Y** (enabled) or **N** (not enabled). If a measurement is not available, **D** is displayed after the descriptor. Table 4–1 further explains the menu options.

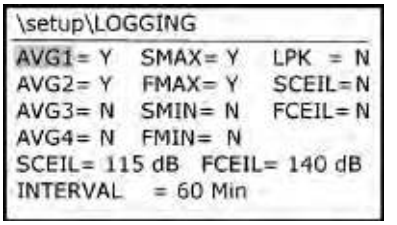

Figure 4–6: Logging Setup display

NOTE: Logging settings may be changed only during a closed session. You can reset to close the session ("Reset operation" on page 11). For ***DLX*** models, you can also close a session in the Start display ("Closing sessions" on page 14).

Table 4–1: Explanation of logging options

Logging Menu options	Explanations[a]
AVG (1–4)	Time-average sound level for each dosimeter.
SMAX	Maximum level at slow time response.
FMAX, IMAX	Maximum level at fast time response.
SMIN	Minimum level at slow time response.
FMIN, IMIN	Minimum level at fast time response.
LPK	Peak level (unaffected by time response setting).
SCEIL	Measure of how long during a logging interval that the level at slow time response exceeds the Slow Ceiling threshold.
FCEIL	Measure of how long during a logging interval that the level at fast time response exceeds the Fast Ceiling threshold.
INTERVAL	Logging interval time (range: 1 second to 60 minutes in 11 steps).

a) Some options are different for an Impulse time response ("Impulse exceptions" on page 27*).*

➤ **To enable/disable logging**

You can individually enable and disable time-average logging (AVG) for each dosimeter. You can also enable and disable logging for the maximum and minimum levels and for the ceiling times.

NOTE: If **D** is shown for a dosimeter, that dosimeter is currently disabled ("Assigning a setup to a dosimeter" on page 37).

1. In the Logging Setup display, cursor to highlight the option.
2. Press ↵ to toggle the setting to **Y** or **N**.
3. Press ↩ to escape the display.

➤ **To change a ceiling setting**

1. In the Logging Setup display, cursor to highlight either **SCEIL** or **FCEIL** below the toggle options (they are followed by threshold settings).
2. Press ↵ to move the highlighting to the current ceiling setting.
3. Press ▲▼ to select a new setting
4. Press ↵ to change it.
5. Press ↩ to escape the display.

➤ **To change the interval**

This setting determines the logging rate (inverse of the interval).

1. In the Logging Setup display, cursor to highlight **INTERVAL**.
2. Press ↵ to move the highlighting to the current interval setting.
3. Press ▲▼ to select a new setting
4. Press ↵ to change it.
5. Press ↩ to escape the display.

Impulse exceptions

If the time response is set to Impulse, the impulse measurements take the place of FMAX and FMIN. Also, some of the other measurements in the display are unavailable and are shown as disabled (**D**). This may include disabled dosimeters as well ("Assigning a setup to a dosimeter" on page 37).

- The FMAX and FMIN descriptors are re-named IMAX and IMIN.
- SMAX and SMIN are disabled.
- FCEIL and SCEIL are disabled.

Comm Set

The Comm Set display allows you to choose between a wireless infrared or a cabled RS-232/USB interface for communication with external devices. However, because cabled communication is not supported at this time, you should always have the communications interface set to infrared.

When entering this display, **INTERFACE** is highlighted. If ***NoisePro*** is set properly, **INFRARED** is indicated in that line of the display. If set incorrectly, **RS-232/USB** is indicated, and you should change it.

➤ **To choose the Infrared interface**

1. With **INTERFACE** highlighted, press so that **INFRARED** is indicated. This key acts as a toggle between the two interfaces. The indicated communication rate will be 115200 baud; it cannot be changed.
2. Press to escape the display.

Language

Use the Language display to choose from among five languages for display text. An asterisk appears next to the selected language.

➤ **To change language**

1. In the Language display, press to cursor to your choice
2. Press to make the change.
3. Press to escape the display.

Display

The Display Menu provides display control and information functions.

Contrast

The contrast setting affects the intensity of the text in relation to the background. Higher numbers mean more contrast.

➤ **To change contrast**

1. In the Display Menu, press ▲▼ to highlight **CONTRAST**.
2. Press ▲▼ to modify the value.
3. Press ↵ to make the change.
4. Press ↩ to escape the display.

Backlighting

The power required to illuminate the display can be significantly greater than the power required for all other functions in the instrument. The less power you use for illumination purposes, the longer the replaceable batteries will last.

You can control backlighting with three options.

- **Off** ~ No backlighting under any conditions.
- **Key** ~ Backlighting only when a key is pressed.
- **Auto** ~ Backlighting only when ambient lighting is low.

➤ **To control backlighting**

1. In the Display Menu, press ▲▼ to highlight **BACKLIGHT**.
2. Press ↵ to toggle between the three options.
3. Press ↩ to escape the display.

Measurement descriptors

The Descriptors setting determines whether the Basic or IEC/ISO descriptors are used to report measurement results. For an explanation of these descriptors, see Appendix A , "Glossary."

➤ **To change Descriptors**

1. In the Display Menu, press ▲▼ to highlight **DESCRIPTORS**.
2. Press ↵ to toggle the setting.
3. Press ↩ to escape the display.

View *NoisePro* information

This display contains information about the instrument and about Quest.

➤ **To view identifying information**

1. In the Display Menu, press ▲▼ to highlight **UNIT INFO**.
2. Press ↵ to view the information.
3. Press ↩ to escape the display.

Vibrating belt clip

The optional vibrating belt clip can alert you with tactile feedback. For information about installing the vibrating belt clip, see "Exchanging belt clips" on page 67.

For all ***NoisePro*** models, the Time Weighted Average measurement of dosimeter 1 (DOSE1) serves as the reference. For the ***DLX***, the logged L_{AVG} may also serve as a separate reference. When a measurement exceeds the reference threshold, the belt clip is activated. For the TWA reference, the vibration lasts one second, then turns off and stays off. For the L_{AVG} reference, the vibration alert lasts one second and may reactivate on each log interval.

NOTE: Only dosimeter 1 is used for vibration triggering. If you disable DOSE1 for any ***NoisePro*** model, vibration triggering is unavailable ("Assigning a setup to a dosimeter" on page 37). If you disable the logging of AVG1 for a ***DLX*** model, vibration triggering on L_{AVG} is unavailable ("Logging" on page 26).

Setting the trigger(s)

The conditions for vibration triggering are established in the Vibration Setup display (Figure 4–7).

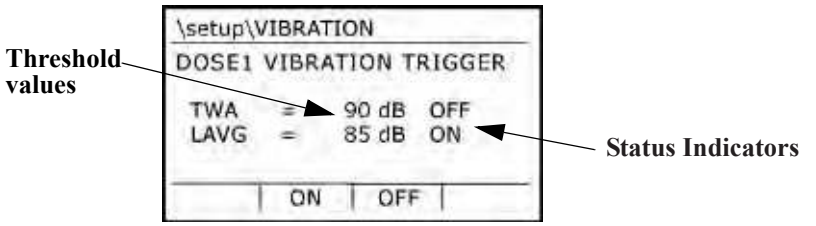

Figure 4–7: ***DL*** and ***DLX*** Vibration Setup display

➤ **To change the vibration setup**

1. [For the ***DL*** and ***DLX*** only] In the Vibration Setup display, press ▲▼ to highlight either TWA or L_{AVG}.
2. Press ↵ to enter the threshold value field.
3. Press ▲▼ to change the setting.
4. Press ↵ to save the new value.
5. Press the **ON** or **OFF** softkey to enable or disable the trigger. The Status Indicator changes to reflect your choice.
6. [For the ***DL*** and ***DLX*** only] If you want to set the second trigger, repeat all steps above.
7. Press ↩ to escape the display.

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CHAPTER

5

Configuring dosimeters

This chapter explains how to view and define the setup conditions under which the ***NoisePro*** dosimeters operate.

What is a dosimeter setup?

The performance of a noise dosimeter is controlled by commonly recognized parameters that regulate how the dosimeter responds to time-varying noise signals. When reporting dosimetry results, the settings of several critical parameters must be reported at the same time so that meaningful comparisons can be made.

The collection of settings to the parameters that control a dosimeter is known as the dosimeter setup. ***NoisePro*** provides nine dosimeter setups, and any of them can be assigned to any dosimeter. Some of the setups have fixed settings that you cannot change; others allow you to make changes that conform to your own requirements. When you configure a dosimeter, you assign one of these nine setups to it.

Pre-defined setups

Six of the nine dosimeter setups are factory-defined, and five of those six cannot be changed by a user. These factory assignments conform to standards established for noise dosimetry in the United States and the European Union.

The five that are fixed comply with standards established by the Occupational Health and Safety Administration (OSHA), the Mine Safety and Health Administration (MSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH). The sixth, labeled 200310EC, complies with minimum requirements under Directive 2003/10/EC of the European Union. The settings to the 200310EC parameters can be changed to accommodate preferences for more stringent standards in member EU countries.

These six pre-defined setups and their respective parametric settings are identified in Table 5–1. The tags, HC and PEL, refer to hearing conservation (HC) and Permissible Exposure Limit (PEL) levels that are defined in regulatory standards. See Appendix , “Glossary,” for information about these standards and levels.

Table 5–1: Parametric settings for pre-defined setups

Setup	Response	Exchange Rate	Criterion Level	Criterion Time	Threshold	Upper Limit
OSHA HC	**Slow**	**5 dB**	**90 dB**	**8 Hr**	**80 dB**	**115 dB**
OSHA PEL	**Slow**	**5 dB**	**90 dB**	**8 Hr**	**90 dB**	**115 dB**
MSHA HC	**Slow**	**5 dB**	**90 dB**	**8 Hr**	**80 dB**	**115 dB**
MSHA PEL	**Slow**	**5 dB**	**90 dB**	**8 Hr**	**90 dB**	**115 dB**
ACGIH	**Slow**	**3 dB**	**85 dB**	**8 Hr**	**80 dB**	**115 dB**
200310EC	**Fast**	**3 dB**	**85 dB**	**8 Hr**	**Off**	**115 dB**

User-defined setups

NoisePro has three additional setups that are labeled User 2, User 3 and User 4. You can change any of the settings in these setups and save the results. User setups can be assigned to a dosimeter and used just like pre-defined setups with one exception: you cannot make an assignment that contains settings that are incompatible with those in use by another dosimeter. When a conflict occurs, you have several options to resolve it ("Conflict resolution" on page 38).

Dosimeter setup displays

View, change and perform other tasks with dosimeter setups in the cascading group of displays shown for the ***DLX*** in Figure 5–1. If you are not using the ***DLX***, some of the features will be absent.

- **Dosimeters ~** The **DOSE3** and **DOSE4** softkey options are absent in other models. Only the ***DLX*** has four dosimeters.
- **Setup display ~** The **LOGGING** option in the Setup display is absent for the other models.

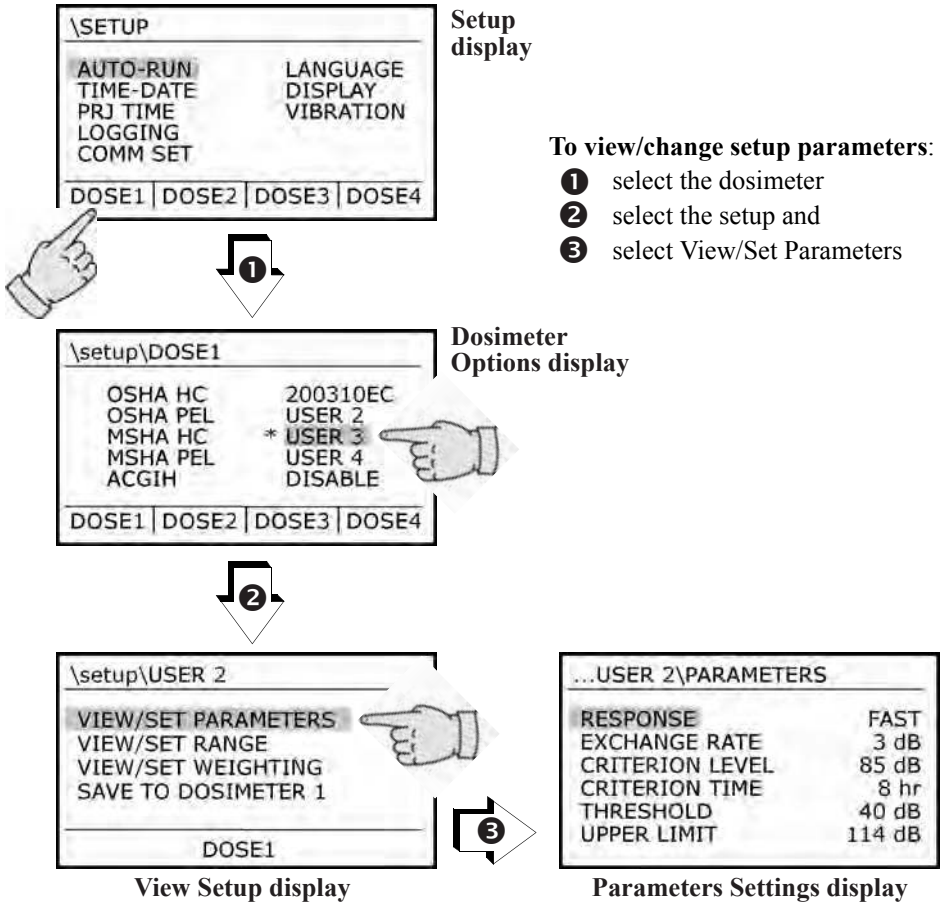


Figure 5–1: Working with dosimeter setups (***DLX*** displays shown)

Dosimeter Options display

Open the Dosimeter Options display by pressing either dosimeter softkey in the Setup display. The Navigation Line identifies the dosimeter you selected. The setup currently assigned to the selected dosimeter is highlighted and marked with an asterisk.

View Setup display

Open the View Setup display by pressing a dosimeter softkey in the Dosimeter Options display. The selected dosimeter is identified at the bottom of the display. The setup currently assigned to the selected dosimeter is identified in the Navigation Line.

Parameter Settings display

View parameter settings or make changes to them in the Parameter Settings display. Open the Parameter Settings display for a setup selected in the View Setup display.

NOTE: Parameter settings may be changed only during a closed session. You can reset to close the session ("Reset operation" on page 11). For ***DLX*** models, you can also close a session in the Start display ("Closing sessions" on page 14).

➤ **To view setup parameters and settings**

1. In the Dosimeter Options display, press ▲▼ to cursor to a setup option.
2. Press ↵ to complete the selection. The View Setup display opens.
3. Press ▲▼ to cursor to **VIEW/SET PARAMETERS**.
4. Press ↵ to complete the selection. The Parameter Settings display opens.

➤ **To make changes in the Parameter Settings display**

You can make changes to the 200310EC setup or to any of the three User setups. The changes are automatically saved to the selected setup as you go along.

1. Press ▲▼ to cursor to the parameter you want to change.
2. Press ↵. The highlighting moves to the setting.
3. Press ▲▼ one or more times to select an option or change the value.
4. Press ↩ to return to the View Setup display.

Changing range and weighting settings

Each setup has a range and weighting setting. You can make changes to the 200310EC setup or to any of the three User setups. The changes are automatically saved to the selected setup.

NOTE: Range and weighting may be changed only during a closed session. You can reset to close the session ("Reset operation" on page 11). For ***DLX*** models, you can also close a session in the Start display ("Closing sessions" on page 14).

➤ **To change the range**

1. In the View Setup display, press ▲▼ to cursor to **VIEW/SET RANGE**.
2. Press ↵. The Range Change display appears.
3. Press ↵ one or more times to choose a setting.
4. Press ↩ to return to the View Setup display.

➤ **To change the weighting**

You can independently set the weighting for the peak and rms channels.

1. In the View Setup display, press ▲▼ to cursor to **VIEW/SET WEIGHTING**.
2. Press ↵. The Weighting Change display appears.
3. Press ▲▼ to select either the peak or the rms channel. You have two options for the peak channel and three options for the rms channel. Press
4. Press ↵ one or more times to choose a setting.
5. Press ↩ to return to the View Setup display.

Assigning a setup to a dosimeter

You can assign a setup to a dosimeter independently of making changes to setups. You may need to resolve one or more conflicts before making an assignment ("Conflict resolution" on page 38).

NOTE: Setups may be assigned only during a closed session. You can reset to close the session ("Reset operation" on page 11). For ***DLX*** models, you can also close a session in the Start display ("Closing sessions" on page 14).

➤ **To assign a setup**

This procedure assumes that you're making the assignment independently of changing the setup. If you're making the assignment as part of changing the setup you wish to assign, skip directly to step 3 below.

1. In the Setup display, press a softkey to select a dosimeter. (You can also select it in the Dosimeter Options display.)
2. In the Dosimeter Options display, press ▲▼ to cursor to a setup option.
3. In the View Setup display, press ▲▼ to cursor to **SAVE TO DOSIMETER X**, where **X** is the number of the dosimeter you selected in step 1.
4. Press ↵. If the setup is allowable, the Dosimeter Options display appears. If not, a conflict resolution display appears. See below.

➤ **To disable a dosimeter**

You can disable a dosimeter by following the procedure above for assigning a setup, except in step #2, select **DISABLED**. When disabled, no data is processed or stored for that dosimeter. Enable a disabled dosimeter by assigning any available setup to it.

Conflict resolution

Conflicts can exist for the following settings, but only for enabled dosimeters.

- **Impulse time response** ~ Cannot be mixed with Slow or Fast settings.
- **Range** ~ Must be the same for all dosimeters that are enabled.
- **Weighting** ~ Must be the same for all dosimeters that are enabled.

A conflict cannot exist between dosimeters if only one dosimeter is enabled. For that reason, one way to resolve a conflict is to intentionally disable all other dosimeters ("To disable a dosimeter," above).

The other way to resolve a conflict is by means of the conflict resolution displays. A conflict resolution display appears whenever a conflict exists at the time of setup assignment. If more than one conflicting condition exists, the conflict resolution displays appear in sequence. Each conflict resolution display gives you two options.

- **Save** ~ Press ↵ to approve the new assignment. ***NoisePro*** resolves the conflict by disabling the other dosimeter(s).
- **Escape** ~ Press ↩ to exit the conflict resolution display with no change. You might consider changing setups, if possible, to remove the conflict.

CHAPTER 6

Examining results

This chapter explains how to examine measurement results in the ***NoisePro*** display as they are obtained or when retrieved from session memory. For information about examining results externally, see Chapter 8, "Communications."

Selecting the source

You can view or review measurement results. Viewing means to look at the most current measurements. Reviewing means to look at measurements resulting from a completed study or, in the case of a ***DLX***, resulting from a previous session.

Viewing current results

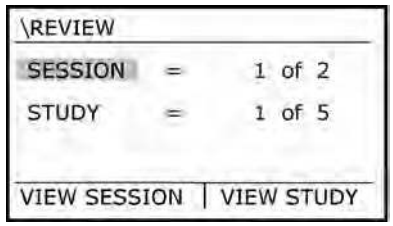
In the Start display, press ▲▼ to select either **VIEW CURRENT STUDY** or **VIEW SESSION** (will be marked **VIEW CURRENT SESSION** if you are using a ***DLX***), then press ↵. The Results display appears.

Current results means the most recent measurements by ***NoisePro***. If you're viewing while running a study, the results are being acquired and displayed as you watch. If you're viewing a study during a pause, the final results from the last study performed are displayed.

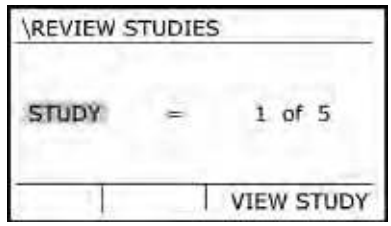
NOTE: Except for the sound level measurement (first measurement in the Level category), all results are cleared in the display after a Reset. If you are using a ***DLX***, results are also cleared when a session is closed

Reviewing previous results

In the Start display, press ▲▼ to select **REVIEW STUDIES** (will be marked **REVIEW** if you are using a ***DLX***), then press ↵. The Source Selection display appears (Figure 6–1).



***NoisePro DLX* display**



***NoisePro* and *NoisePro DL* display**

Figure 6–1: Source Selection display

Reviewing results

You can review results for a previous study during a session pause. If you are using a ***DLX***, you can review results for a previous session in memory if the current session is closed. To review current study or session results, see "Viewing current results" on page 39.

If you are using a ***DLX***, select the session before selecting the study. If using one of the other ***NoisePro*** models, go directly to "To select the study," below.

➤ **To select the session (DLX only)**

Opposite the word **SESSION** in the display are two numbers. The first number is the selected session. The second number tells you how many sessions are in memory (Reset sets this value to zero).

1. Cursor to highlight **SESSION**, then press ↵. The highlighting moves to the selection field.
2. Press ▲▼ to change the selected session, then press ↵ to return.
3. If reviewing study results, continue with "To select the study," below. If reviewing session results, press **VIEW SESSION**.

➤ **To select the study**

Opposite the word **STUDY** in the display are two numbers. The first number is the selected study. The second number tells you how many studies are in the session (Reset sets this value to zero).

1. Cursor to highlight **STUDY** (***DLX*** only)
2. Press . The highlighting moves to the selection field.
3. Press to change the selected study, then press to return.
4. Press **VIEW STUDY**. The Results display appears.

Results display

Data is presented for viewing in the Data Results display (Figure 6–2).

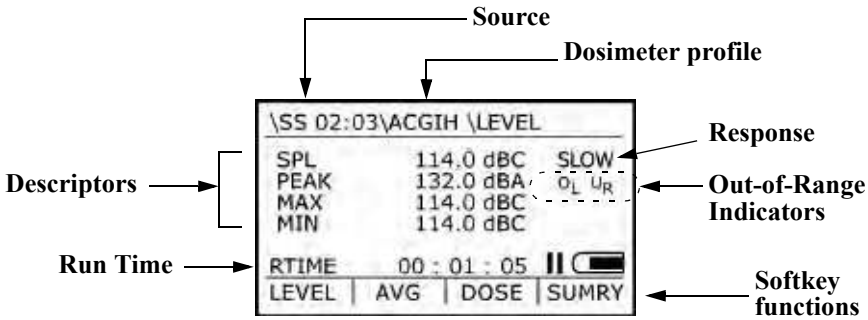


Figure 6–2: Results display

Display characteristics

Source	Identifies the source of the information on display (“Specific source” on page 43.
Dosimeter profile	Name of the profile assigned to one of the active dosimeters which sets the conditions for these measurement results.
Descriptors	Measurements made, separated into level, average and dose categories. For example, in Figure 6–2 the Level category contains the SPL, Peak, Max and Min descriptors.
Run time	Run Time (RTIME) is given in hours, minutes and seconds (“Run Time” on page 4). You can determine whether a study is currently running by looking to see if RTIME is increasing or not.
Response	Response setting for the selected dosimeter profile. To change this setting, see “Parameter Settings display” on page 36.
Out-of-Range Indicators	Normally nothing appears in this area. If you see either $\mathbf{O_L}$ or $\mathbf{U_R}$ there, this means an out-of-range condition occurred. See “Out-of-Range Indicators” on page 43 for an explanation.
Softkey functions	Use these to select the descriptor category or to show an interpretive summary (“Interpreted summaries” on page 44).

What you see in the Data Results display depends upon a number of factors.

- **Descriptor notation** ~ Descriptors can be shown according to your choice of notation (“Measurement descriptors” on page 30).
- **History** ~ The mode of presentation is saved between visits. Each time you visit you return to the same presentation settings you had on your previous visit (or a default presentation on your first visit).
- **Single/Group toggle** ~ You can view smaller presentations of all measurements in a category at once or a larger presentation of one measurement at a time. Press to toggle between the single and grouped presentations.

Selecting with arrow keys

Use the arrow keys to step through measurements, measurement categories and dosimeters.

- Press to step through measurements or groups of measurements, according to the current single/group toggle setting.
- Press to step through the dosimeter setups.

Specific source

The specific source for the results showing in the display depends upon which ***NoisePro*** model you're using, whether you're viewing or reviewing and whether the subject is a study or session.

- **Viewing the current study** ~ The word "Study" is shown, followed by the 2-digit number of the study. For example, \STUDY 03\ .... for study 3.
- **Viewing the current session** ~ The word "Session" is shown.
- **Reviewing a study** ~ The notation "SS" is shown followed by an identification of the session and the study written as XX:YY. For example, a review of study 3 of session 2 would be shown as 02:03. For non-DLX models, the session number is always "01."
- **Reviewing a session (DLX models)** ~ The word "Session" is shown followed by the 2-digit number of the session. For example, \SESSION 02\ .... for session 2.

Out-of-Range Indicators

The Out-of-Range Indicators tell you when the input signal is above or below the linear operating range of the instrument.

- **O_L appears** ~ The signal was too large and an overload occurred.
- **U_R appears** ~ The signal was too small to be separated from instrument noise ("Noise Floor" on page 63).

If an overload occurs while you are running a study, the OL Indicator appears and stays there. If you are viewing a previous study or session results during which an overload occurred, the OL Indicator appears in the display. If you're monitoring sound levels without recording, the OL Indicator appears only during an overload event, then goes away when the sound level returns to the normal operating range.

SLM measurements

The first measurement in the Level category reports the current sound level. This measurement is always displayed, even after a Reset and when you close the session (***DLX*** models only). In effect, you can monitor the sound level as you would with a sound level meter by viewing this measurement. You can use arrow keys to select which dosimeter is used for the measurement ("Selecting with arrow keys" on page 42). For more information about operating the ***NoisePro*** like a sound level meter, see "Area monitoring" on page 2.

Interpreted summaries

Direct measurements of the TWA and Dose, and calculated measurements of PTWA and PDose, are repeated and interpreted in the Summary display. This display also shows the Upper Limit threshold and time the noise ranged above that threshold.

Press **SUMRY** in the Results display to view interpreted summaries and Upper Limit threshold information (Figure 6–3).

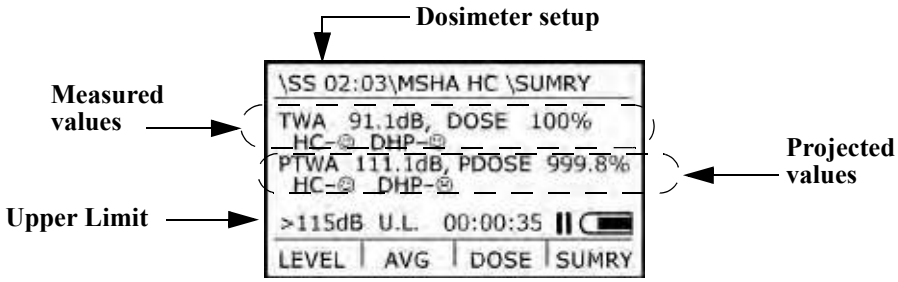


Figure 6–3: Summary display

Selecting dosimeters

You can view results for each enabled dosimeter. Press ◀▶ to switch between the dosimeters.

Alert levels

Icons in the Summary display represent ranges above or below an Alert Level. When the measured or projected time-weighted average is below the Alert Level, a happy face icon (favorable result) is shown. When the measured or projected time-weighted average is equal or above the Alert Level, a sad face icon is shown (unfavorable result). Because Alert Levels are typically set to compliance levels, these icons represent real-time compliance indicators.

For some pre-defined setups, a second Alert Level exists. For user setups, you can set one or two Alert Levels. To create user setup Alert Levels, define them in ***QuestSuite Pro***™ and download them to the ***NoisePro*** ("Comm display" on page 53).

When there are two Alert Levels, the interpretations for each are given below the measured and projected values (Figure 6–3). There can be an overlapping range for the two Alert Levels where they give different indications (Figure 6–4).

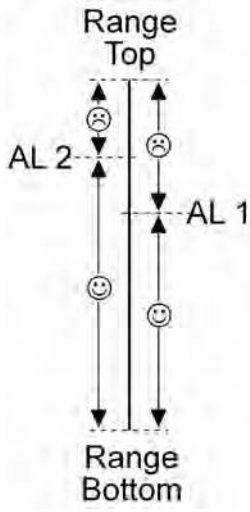


Figure 6–4: Alert Levels (AL 1 & 2)

Each compliance icon is tagged to show the purpose of that particular Alert Level. For pre-defined Alert Levels, these tags are for hearing conservation (HC), permissible exposure limits (PEL) and dual hearing protection (DHP). See Appendix , "Glossary," for information about these purposes. For user-defined Alert Levels, the tags are exclamation points (!) with no pre-defined meaning. Users attach their own interpretation to these indicators.

Table 6–1 identifies the Alert Level settings for all the dosimeter setups and how the real-time compliance indicators provide interpretations in relation to those Alert Levels.

Table 6–1: Setups, Alert Levels and tagged compliance indicators

Dosimeter Setup	Alert Level 1	Alert Level 2	Below an Alert Level	Equal to or above an Alert Level
OSHA–HC	85 dB (HC)	Not applicable	HC–☺	HC–☹
OSHA–PEL	90 dB (PEL)	Not applicable	PEL–☺	PEL–☹
MSHA-HC	85 dB (HC)	105 dB	HC–☺ DHP–☺	HC–☹ DHP–☹
MSHA-PEL	90 dB (PEL)	105 dB	PEL–☺ DHP–☺	PEL–☹ DHP–☹
ACGIH	85 dB (PEL)	Not applicable	PEL–☺	PEL–☹
200310EC	80 dB	85 dB	!–☺ !!–☺	!–☹ !!–☹
USER 2	User defined (!)	User defined (!!)	!–☺ !!–☺	!–☹ !!–☹
USER 3	User defined (!)	User defined (!!)	!–☺ !!–☺	!–☹ !!–☹
USER 4	User defined (!)	User defined (!!)	!–☺ !!–☺	!–☹ !!–☹

NOTE: These compliance indicators are suggestive, not conclusive. You should use all available information including measurement conditions and numerical results as well as these interpretations to arrive at your own conclusions.

CHAPTER 7

Security settings

You can restrict access to the run and setup controls by means of separate security codes, and you can define your own codes. Enable, disable and choose the codes for the security system in the Security Control display.

Secure Run Mode

Use this feature to prevent the termination of a study unless a 4-digit security code is entered correctly. You can enable Secure Run Mode during a study or before you start it. If enabled during a study, ***NoisePro*** enters Secure Run Mode immediately. If enabled before running a study, you can do other things first. Then when you press the Run/Pause key, ***NoisePro*** enters Secure Run Mode.

NOTE: If you turn ***NoisePro*** off when Secure Run Mode is enabled, that security setting remains enabled.

➤ **To enable Secure Run Mode**

1. In the Start display, press the **LOCK** softkey. The Security Control display appears (Figure 7–1). The current status of Secure Run Mode is given below the words, **SECURE RUN MODE**, in the display.

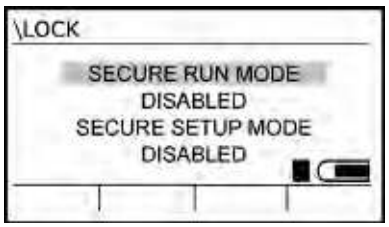


Figure 7–1: Security Control display

2. If **SECURE RUN MODE** is not highlighted, press ▲▼ to highlight it.
3. Press ↵. If changing the status to **ENABLE**, a row of zeros appears below **SECURE RUN MODE** and the first zero is highlighted.
4. Press ▲▼ to set the first digit, then press ↵. The highlighting moves to the next digit.

5. Repeat step 4 for the three remaining digits. When you press ↵ after setting the the fourth digit, Secure Run Mode is enabled.

When Secure Run Mode is enabled

The result of enabling Secure Run Mode depends upon whether you are running a study at that time or not.

- **Not currently running a study** ~ The word **ENABLED** appears below **SECURE RUN MODE** in the Security Control display. You can do anything else you want with ***NoisePro*** until you press ▶‖ to start a study. Once you start a study, the Locked Run display appears (Figure 7–2).
- **Currently running a study** ~ You had started a study before enabling **Secure Run Mode**. As soon as you enable it, the Locked Run display appears (Figure 7–2). From then on, every other function is locked out. The only thing you can do is provide the security code to take ***NoisePro*** out of Secure Run Mode.

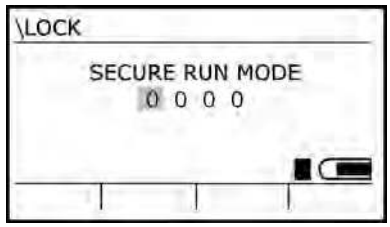


Figure 7–2: Locked Run display

Disable Secure Run Mode

There are two ways to disable Secure Run Mode depending upon whether you're running a study at that time or not.

- **Not currently running a study** ~ Repeat steps 1–3 in the procedure under "Secure Run Mode" on page 47. The word **DISABLE** should appear below **SECURE RUN MODE** in the display.
- **Currently running a study** ~ ***NoisePro*** is showing the Locked Run display. Enter the security code you provided, one digit at a time. If the code is correct, the Security Control display appears with the word **DISABLE** below **SECURE RUN MODE**.

FORGOT THE CODE? Enter the Recovery Code, 9157, which always works.

Secure Setup Mode

Use this feature to prevent changes to any ***NoisePro*** settings. When enabled, an operator can do anything with ***NoisePro*** except change its settings.

NOTE: If you turn ***NoisePro*** off when Secure Setup Mode is enabled, that security setting remains enabled.

➤ **To enable Secure Setup Mode**

1. In the Start display, press the **LOCK** softkey. The Security Control display appears (Figure 7–1).
2. Press ▲▼ to highlight **SECURE SETUP MODE**. If the mode is disabled, **DISABLED** appears below **SECURE SETUP MODE**.
3. Press ↵. If disabled, a row of zeros appears in place of **DISABLED**, with the first zero highlighted.
4. Press ▲▼ to set the first digit, then press ↵. The highlighting moves to the next digit.
5. Repeat step 4 for the three remaining digits. When you press ↵ for the fourth digit, ***NoisePro*** enters Secure Setup Mode. The row of digits is replaced by the word **ENABLED**.

Disable Secure Setup Mode

Repeat steps 1–5 in the procedure given under **"Secure Setup Mode,"** above. If you entered the correct 4-digit code, the word **DISABLED** appears in place of the row of zeros in step 5.

FORGOT THE CODE? Enter Recovery Code, 9157, which always works.

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CHAPTER

8

Communications

NoisePro can communicate with a personal computer and with other ***NoisePro*** units via infrared transmission. This chapter explains the hardware setups and software operations needed to control and execute communications processes.

Purposes of communication

Using QuestSuite Professional

This Quest Technologies application runs in a personal computer under Windows®. ***QuestSuite*** can receive session results from ***NoisePro*** units and provide a wide variety of graphical and reporting functions. For example, ***QuestSuite*** provides printed reports of study and session results. If you don't have ***QuestSuite*** and want to find out how it can work for you, see your dealer.

Shuttling results

You can transfer session results, called shuttling, from any ***NoisePro*** unit to a ***NoisePro DLX*** model. When the transfer is done, the session data is stored in sequence on the ***DLX*** receiving unit but left on the sending unit. By this means, you can monitor with single-session models, shuttle session results to a ***DLX*** for offline processing then clear session memory in the sending unit and begin a new session.

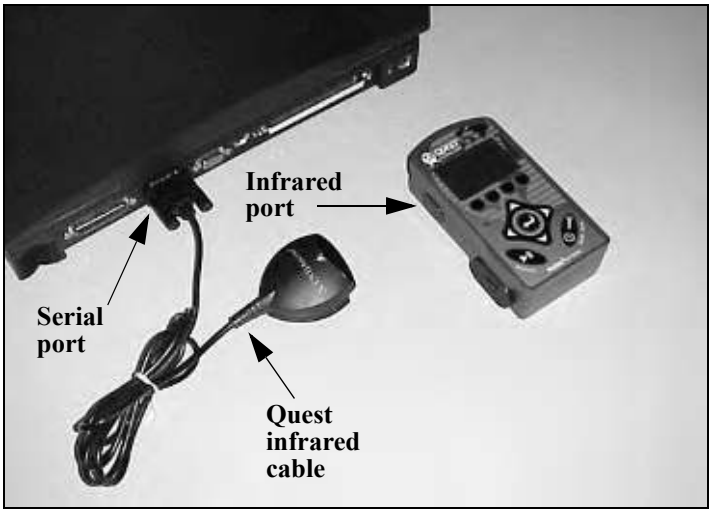
Generating reports

NoisePro units can organize session results into a report format and communicate with a properly configured computer to print the report. For that purpose, your computer must be running a data capture application such as Microsoft® HyperTerminal. For information about HyperTerminal, see the system support information supplied with Windows.

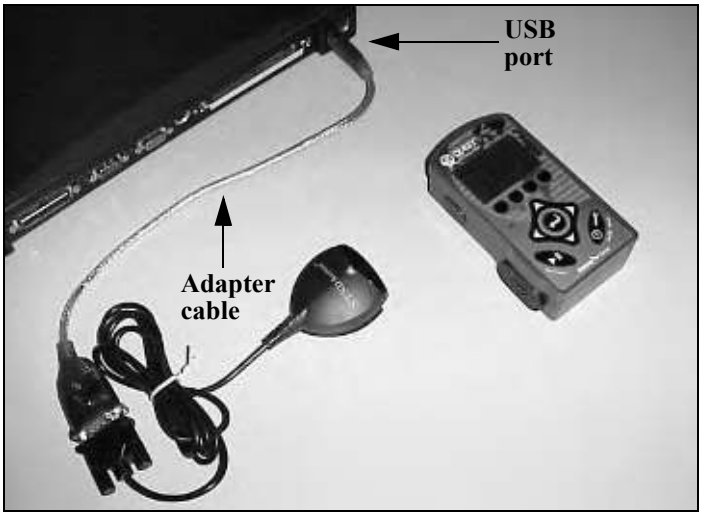
Hardware setup

An infrared cable (part no. 53-857 and standard with most kits) links the 9-pin RS-232C serial (COM) port of your PC to the NoisePro unit's infrared communications port. An optional Serial-to-USB Adapter (part no. 53-810) is also available to mate the 53-857 cable to the USB port of your computer instead of an RS-232C serial

(COM) port. Connect the infrared cable by either means to the computer, as illustrated in Figure 8–1.



Connecting directly to the serial port



Connecting to the USB port using an adapter

Figure 8–1: Infrared cable connections

Software operations

Communications with ***QuestSuite*** and data shuttling between ***NoisePro*** units are managed in the Comm display. Communications with a computer to generate ***NoisePro*** reports are managed in the Print display.

Comm display

In the Start display, press **COMM** to open the Comm display (Figure 8–2).

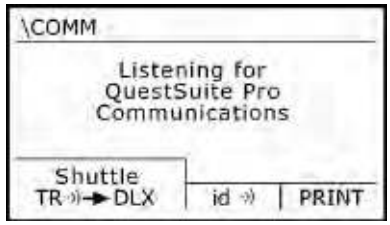


Figure 8–2: Comm display

Communications with QuestSuite

When transferring to ***QuestSuite***, ***NoisePro*** functions passively while ***QuestSuite*** fully manages the transfer. If necessary, press the softkey in accordance with ***QuestSuite*** procedures. For the details, see the ***QuestSuite*** user manual.

Shuttle communications

A shuttle transfer is managed by the sending ***NoisePro*** unit. During that transfer, you will see a series of messages in the Comm display.

- If no communications, you will see "**Listening for QuestSuite Pro Communications**".
- If a transfer process is underway, a progress report will appear consisting of a direction tag (**TX** for transmitting or **RX** for receiving), followed by the number of packets that will be transferred and the current packet number.
- A successful transfer is signalled by a happy face (☺) that appears briefly before "**Listening for QuestSuite Pro Communications**" returns to the display.
- An unsuccessful transfer is signalled by a sad face (☹) that appears briefly before "**Listening for QuestSuite Pro Communications**" returns to the display.

➤ **To shuttle between *NoisePro* units**

1. Position the units so that their infrared windows face each other and are less than one meter apart.
2. Verify that both units have the **COMM** display open.
3. Press the **SHUTTLE** softkey on the sending unit.
4. Watch the progress report to verify a successful transfer (☺). If not successful (☹), repeat steps in this procedure, as appropriate.

Print display

Use the print display to set print options and generate printouts. To open the Print display, press **PRINT** in the Comm display. The appearance of this display varies according to the features available in your model. Figure 8–3 shows the display for ***DLX*** models that operate with four dosimeters and allows logging.

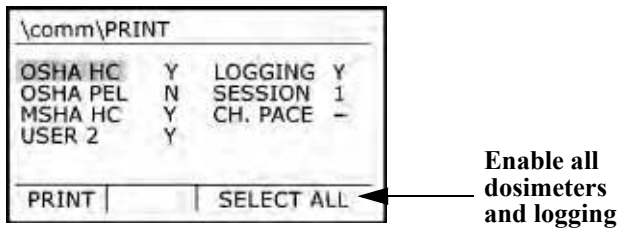


Figure 8–3: ***DLX*** Print display

Printing

You can print from either an open or a closed session. In the general procedure below, you may find that you can skip some or most of the settings for the reasons given. Before pressing **PRINT**, verify the hardware setup ("Hardware setup" on page 51).

1. Select a session. Skip this if you're not using a ***DLX*** model, or if the current session number shown is the one you want to print.

NOTE: If you don't have session data in memory, **N/A** appears in the session number field and printing is impossible.

2. Do any of the following, in any order.

- Select dosimeters, as explained under "Enabling/disabling dosimeters," below. Skip this if the dosimeter selection is the one you want. You can press **SELECT ALL** to quickly include all dosimeters and logging in the printout.
- Select logging, as explained under "Enabling/disabling logging," below. Skip this if the selection is the one you want. You may press **SELECT ALL** at any time to quickly include all dosimeters and logging in the printout.
- Change character pacing, as explained under "Changing character pacing," below. Skip if you find that your printer can keep up with the output or if it's currently set the way you want it.
- You may press **PRINT** to generate the printout at any time.

➤ **To select a session**

This selection applies only to DLX models. For other models, the session number will always be 1 if you have session data in memory.

1. Press ▲▼ to select it to cursor to **SESSION**.
2. Press ↵. The highlighting moves to the session number field.
3. Press ▲▼ to change the session number or press ◀▶ to jump directly to the highest-numbered or lowest-numbered sessions, respectively. The session setting affects the dosimeter information in the Print display as follows.
   - The names may change to reflect the assignment of setups in the session.
   - If a dosimeter shows **DISABLED**, it will not be included in the printout and and cannot be changed from **N**.
4. If all other settings are acceptable, you can press **PRINT** to generate a printout. After the printout, you can change the session number and press **PRINT** with all settings the same except session number, and so on for additional sessions.
5. If you need to set other options in the display, press ↵ to move the highlighting out of the session number field, then proceed as indicated below.

➤ **Enabling/disabling dosimeters**

1. Press ▲▼ to highlight a dosimeter setup.
2. Press ↵ to toggle to **Y** or **N** (Y for enable, N for disable).

NOTE: You may find it faster to press **SELECT ALL**, then disable dosimeters after that. If your instrument allows logging, pressing **SELECT ALL** enables logging too.

➤ **Enabling/disabling logging**

1. Press ▲▼ to highlight **LOGGING**.
2. Press ↵ to toggle to **Y** or **N** (Y for enable, N for disable).

NOTE: Pressing **SELECT ALL** enables logging and all dosimeters at once.

➤ **Changing character pacing**

In most cases, character pacing isn't needed, and when not applied is indicated by a dash (–) next to **CH. PACE** in the display. You'll know that a change is needed if your printout lacks expected characters or some characters are incorrect, suggesting that the transmission rate is too fast.

1. Press ▲▼ to highlight **CH. PACE**.
2. Press ↵ to move the highlighting to the pacing setting.
3. Press ▲▼ to change the setting. A higher number means more time is allowed between characters.

NOTE: Try number 1 first. If you still see dropped or incorrect characters, increment the character pacing number by five, and try again. Experiment to find the lowest setting (fastest rate) that preserves all characters.

4. Press ↵ to move the highlighting back to **CH. PACE**.

Anatomy of a *NoisePro* report

NoisePro reports always include Header, Session and Study sections, but they may include a Logging section as well. The information contained in the report depend upon the capabilities of your ***NoisePro*** model, your settings for the session and your selections in the Print display.

Header

The Header identifies the unit, provides calibration information and identifies the setup parameters for each dosimeter in the report. Space is provided for you to provide a name, location and other comments about the session. Figure 8–4 shows a typical Header.

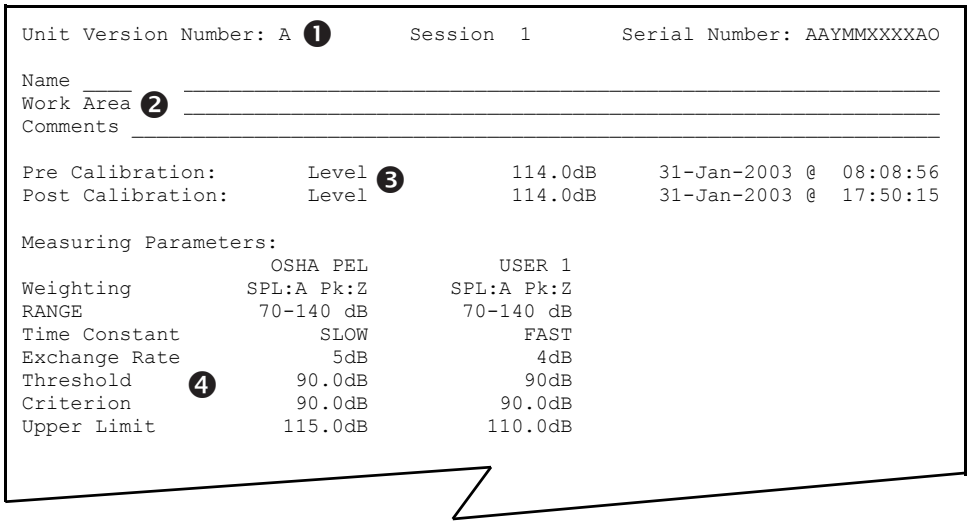
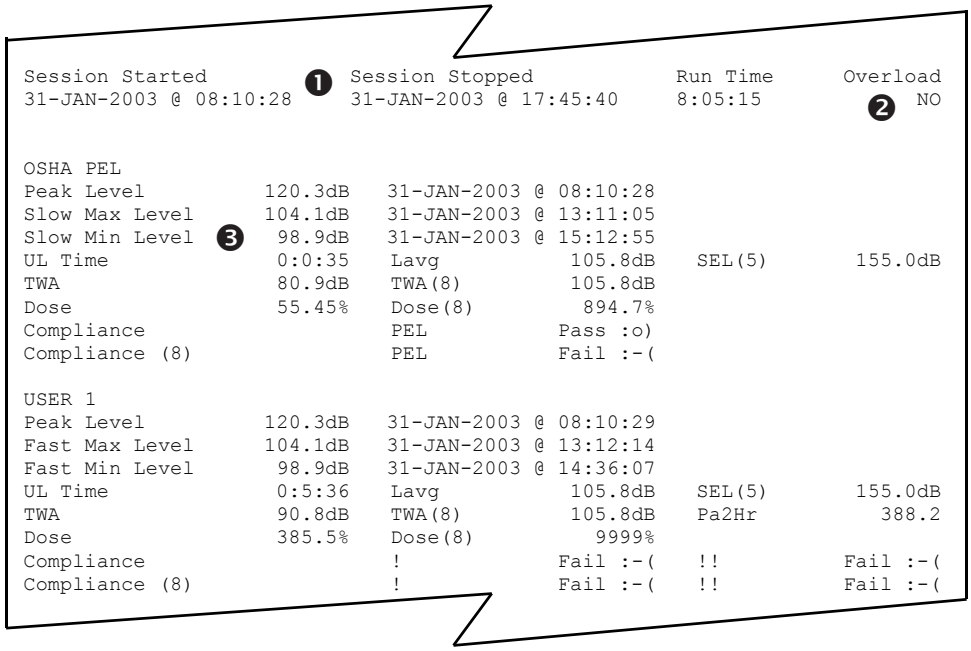


Figure 8–4: Header section

❶	Identifies the ***NoisePro*** unit by installed software and version number. Except for ***DLX*** models, which are multi-session units, the session number is always 1.
❷	Space for hand-written entry.
❸	Specifies pre-calibration and post-calibration information, as available.
❹	Tabulates settings for each dosimeter included in the report.

Session section

The Session section follows the Header. An example of a Session section is shown in Figure 8–5.



```
Session Started          ❶ Session Stopped            Run Time      Overload
31-JAN-2003 @ 08:10:28     31-JAN-2003 @ 17:45:40     8:05:15         ❷ NO


OSHA PEL
Peak Level          120.3dB   31-JAN-2003 @ 08:10:28
Slow Max Level      104.1dB   31-JAN-2003 @ 13:11:05
Slow Min Level   ❸   98.9dB   31-JAN-2003 @ 15:12:55
UL Time               0:0:35   Lavg           105.8dB   SEL(5)       155.0dB
TWA                  80.9dB   TWA(8)         105.8dB
Dose                 55.45%   Dose(8)          894.7%
Compliance                    PEL           Pass :o)
Compliance (8)                PEL           Fail :-(

USER 1
Peak Level          120.3dB   31-JAN-2003 @ 08:10:29
Fast Max Level      104.1dB   31-JAN-2003 @ 13:12:14
Fast Min Level       98.9dB   31-JAN-2003 @ 14:36:07
UL Time              0:5:36   Lavg           105.8dB   SEL(5)       155.0dB
TWA                  90.8dB   TWA(8)         105.8dB   Pa2Hr          388.2
Dose                385.5%    Dose(8)          9999%
Compliance                    !             Fail :-(   !!          Fail :-(
Compliance (8)                !             Fail :-(   !!          Fail :-(
```

Figure 8–5: Session section

❶	Session start, stop and run times.
❷	Overload statement. "**Yes**" appears below "Overload" if an overload occurred during any study in the session.
❸	Session measurement results for one dosimeter, including compliance results in relation to Alert Level(s) ("Alert levels" on page 45). Results for other included dosimeters follow in turn.

Study section

Study sections follow the Session section, in order, for as many studies as were performed in the session. An example of a Study section is shown in Figure 8–6.

```
STUDY (1:2)  ❶ _____________________________________________________________
_____________________________________________________________________________

Post Calibration: ❷  Level            114.0dB     31-Jan-2003 @  17:50:15

Study Started              Study Stopped              Run Time      Overload
31-JAN-2003 @ 13:10:22  ❸ 31-JAN-2003 @ 17:45:40     04:35:18            NO

OSHA PEL
Peak Level          108.0 dB   31-JAN-2003 @ 13:11:05
Slow Max Level       104.1dB   31-JAN-2003 @ 13:11:05
Slow Min Level  ❹     98.9dB   31-JAN-2003 @ 15:12:55   UL Time        0:0:05
UL Time               0:0:0    Lavg           105.8dB   SEL(5)        155.0dB
TWA                  80.8dB    TWA(8)         105.8dB
Dose                  30.5%    Dose(8)          9999%
Compliance                     PEL           Pass :o)
Compliance (8)                 PEL           Fail :-(

USER 1
Peak Level          130.3dB    31-JAN-2003 @ 08:10:29
Fast Max Level      104.1dB    31-JAN-2003 @ 13:12:14
Fast Min Level       98.9dB    31-JAN-2003 @ 14:36:07
UL Time              0:2:05    Lavg           108.8dB   SEL(5)        165.0dB
TWA                  90.8dB    TWA(8)         108.8dB
Dose                385.5%     Dose(8)          9999%
Compliance                     !             Fail :-(   !!           Fail :-(
Compliance (8)                 !             Fail :-(   !!           Fail :-(
```

Figure 8–6: Study section

❶	Identifies this study as the second one in the session (Session:Study). Space is provided here for you to enter your comments about the study.
❷	Post calibration results for this study.
❸	Study start, stop and run times, followed by an overload statement. "**Yes**" appears if an overload occurred during this study.
❹	Study measurement results for one dosimeter, including compliance results in relation to Alert Level(s) ("Alert levels" on page 45). Results for other included dosimeters follow in turn.

Logging section

If you are using a logging dosimeter (***DL*** and ***DLX*** models only) and included logging in the Print display, the Logging section follows the last Study section. Some information may be missing from the Logging session.

- If a dosimeter was disabled during the session, no logging results are available for it ("Assigning a setup to a dosimeter" on page 37).
- If a dosimeter was disabled in the Print display, no logging results will be printed for it ("Printing" on page 54).
- ***DLX only:*** If logging for a dosimeter was disabled in the Logging Setup display, no logging results are available for it ("Logging" on page 26).
- ***DLX only:*** If maximum, minimum or peak results are disabled in the Logging Setup display, they will be absent from the logging report ("Logging" on page 26).

Logging results are printed study-by-study, in order. An example of a portion of a Logging section for one study is shown in Figure 8–7.

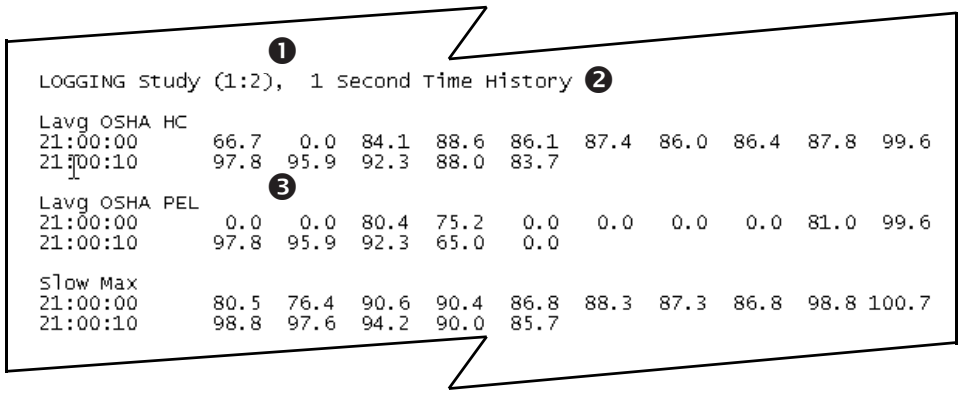


Figure 8–7: Logging section

❶	Identifies the source of the logged data (Session**:**Study).
❷	Identifies the logging interval.
❸	Logged values for enabled dosimeters and measurements.

CHAPTER 9

Application topics

Adding and subtracting levels

You can use ***NoisePro*** and a simple graphical technique to remove background noise from a measurement. With a slight variation in the same procedure, you can mathematically combine the effects of isolated noise sources as if they were operating in an area at the same time.

For both purposes, you must have two, independent measurements under the same setup conditions. This technique applies to steady-state, averaged or integrated measurements but not to transient measurements such as peaks, maximums and minimums.

Background noise

Background noise can cause considerable error in measurement when its level is high relative to the level of a noise source of interest. If you can make measurements both with and without the contribution of a noise source of interest, you can mathematically subtract the background noise from the combined measurement, yielding the level of the noise source of interest alone. The accuracy of this determination improves as the difference between the two measurements increases.

➤ **To remove background noise**

1. Obtain a measurement that includes the contribution of the noise source of interest (the combined measurement).
2. Make a second measurement under exactly the same conditions as in Step 1 but without the presence of the noise source of interest (the background noise measurement).
3. Determine the decibel difference between these two measurements.
4. Find that difference on the x-axis of Figure 9–1.
5. Find the point on the curve directly above this difference.
6. Read the corresponding value on the y-axis for that point (the correction value).
7. Subtract the correction value from the combined measurement.

Example ~ Measurements with and without the noise source of interest are 91 dB and 90 dB, respectively. For a difference of 1 dB, the background noise correction

value is 7 dB. Therefore the level for the noise source of interest without the noisy background is 84 dB.

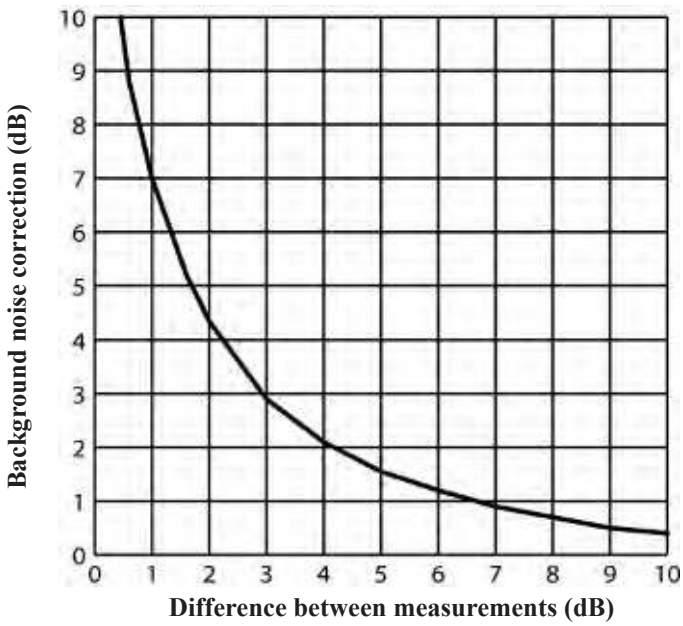


Figure 9–1: Background noise correction chart

Combining noise sources

The procedure for mathematically determining a combined level of sound from independent measurements made for two noise sources is given below.

1. Make independent measurements for both noise sources, where each exists without the presence of the other.
2. Determine the decibel difference between these two measurements.
3. Find that difference on the x-axis of Figure 9–2.
4. Find the point on the curve directly above this difference.
5. Read the corresponding value on the y-axis for that point (the Amount to Add).
6. Add this value to the largest of the two measurements.

Example ~ Independent measurements for the two noise sources yielded levels of 90 dB and 91 dB. For a difference of 1 dB, the correction factor taken from the curve

in Figure 9–2 is 2.5 dB. Therefore the combined level when these two sound sources are present in the measurement area at the same time 93.5 dB.

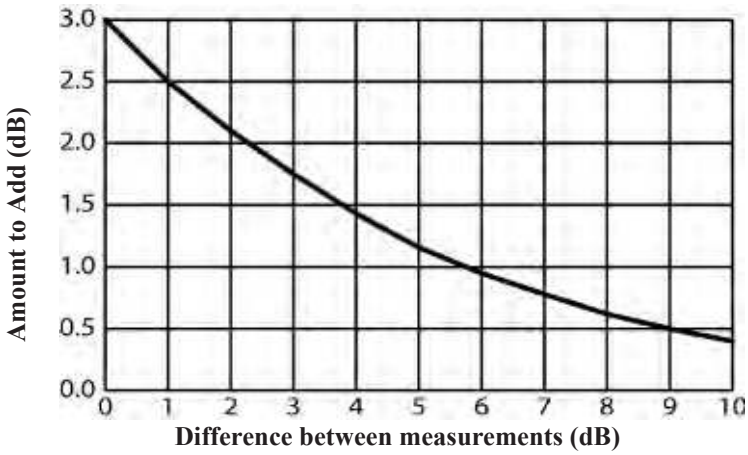


Figure 9–2: Combining measurements chart

Noise Floor

In a "Perfectly Quiet" room, the electrical noise produced by the microphone is approximately 35 dB on A-weighting and 45 dB on C-weighting. These levels are known as the Noise Floor of the instrument. The Noise Floor can cause inaccurate measurements at low measurement levels.

Measurements must always be at least 5 dB above the Noise Floor to be valid. Therefore, the lowest valid measurements of the dosimeter are approximately:

- 40 dB on A-Weighting.
- 50 dB on C-Weighting.

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CHAPTER
10

Maintenance

When replacing the main ***NoisePro*** batteries, make sure to use approved batteries and to heed battery replacement warnings given below.

WARNING: To prevent ignition of flammable or combustible atmospheres, no user serviceable parts inside. Repair should be done by authorized service personnel only.

Approved batteries

Use only approved AA batteries from the following list.

- Eveready E91 Energizer “Max”
- Eveready EN91 Energizer “Industrial”
- GE/Sanyo “Power Cell”

WARNING: To reduce the risk of explosion, do not mix used batteries with unused batteries or mix batteries from different manufacturers.

Replacing batteries

Replace the batteries when the word, **LOBAT**, appears in place of the battery icon. Stored data and user settings are unaffected by battery replacement.

WARNING: To reduce the risk of ignition of a flammable or explosive atmosphere, batteries must be changed only in a location known to be non-hazardous.

➤ **To replace AA batteries**

See Figure 10–1 for an identification of the parts mentioned below.

1. Remove the battery cover by twisting its screw 1/4 turn counter-clockwise (a small coin will work).
2. Remove and dispose of both batteries.
3. Insert two fresh AA batteries, aligning them in opposite directions as shown in the illustration.
4. Orient the battery cover so that the spring contact is at the bottom.
5. While holding the cover over the cavity, twist the screw clockwise to secure it.

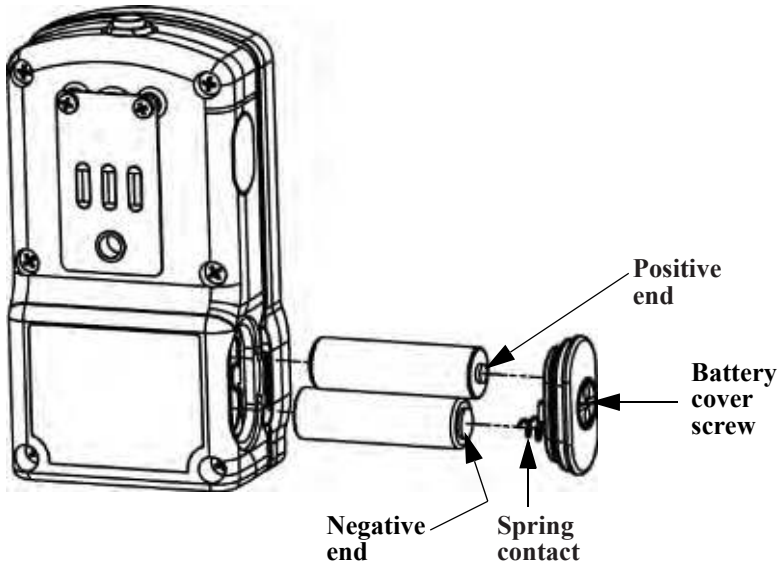

Figure 10–1: Battery replacement

Exchanging belt clips

NoisePro comes with a standard clip that fits over a belt. As an option, you can replace the standard belt clip with a vibrating belt clip (Figure 10–2). The vibration is triggered when measured noise exceeds one or more pre-set levels ("Vibrating belt clip" on page 30).

You can exchange the standard and vibrating belt clips in the field with just a small Phillips screwdriver.

➤ **To install the vibrating belt clip**

The vibrator gets its power through an electrical connector located below the belt clip.

1. Remove the two screws at the top of the standard belt clip.
2. Pry off the power connector cap using your fingers.
3. Plug the vibrating belt clip plug into the case connector, then orient the connector so that the screw holes in the belt clip and the case line up.
4. Reinstall and tighten the two screws.

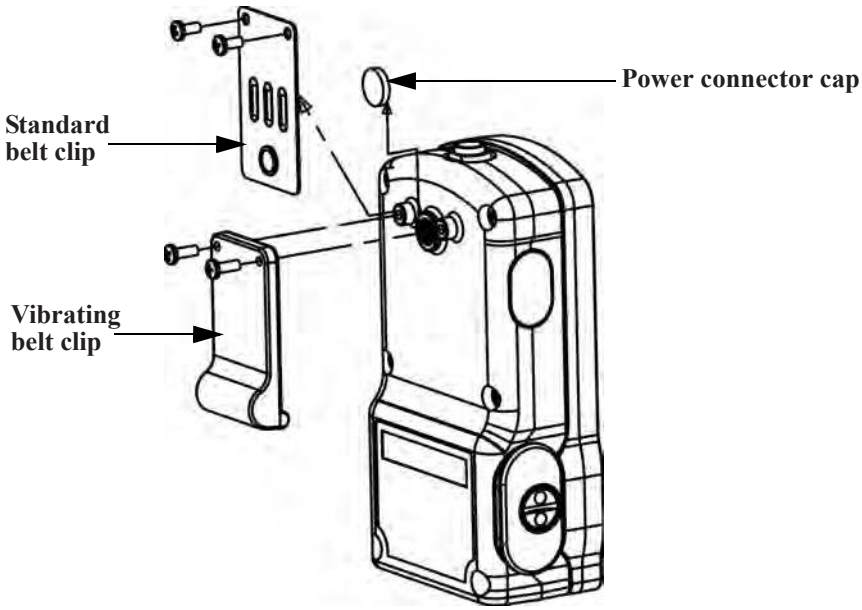

Figure 10–2: Belt clip assembly

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CHAPTER 11

Technical support

Troubleshooting

Blank display

- Unit lost power. Replace batteries with fresh ones.
- If fresh batteries do not resolve the problem, return the unit for service.

General calibration problems

- Verify that calibrator **LOBAT** indicator isn't on. **LOBAT** means that the calibrator battery must be replaced.
- For a multiple frequency calibrator, verify that the frequency is set to 1000 Hz.
- Make sure you can hear a tone from the calibrator.
- If you cannot determine the reason for the problem, contact Quest Technical Services for assistance.

Pre-calibration value not saved

- See "General calibration problems," above.
- Repeat the calibration, verifying that your adjusted setting in the Calibration display matches the posted output of the calibrator.
- If the repeated attempt fails and you have another microphone (for example a boom-mounted microphone), exchange the microphones and try again.

Post-calibration discrepancy

- See "General calibration problems," above.
- If you have a different calibrator with the same output level, use it to repeat the post-calibration.

Unit is erratic

- Verify the microphone if you have another one. (The microphone or preamp could be intermittent).
- If the microphone seems okay, return the unit for service.

Clock settings lost

- If the settings are lost while replacing the AA batteries, the internal Lithium battery may be weak and need replacement. Return the unit to the factory for service. See "Factory service," below.

Belt clip vibrator not working

- Verify that at least one trigger is enabled. See "Vibrating belt clip" on page 30.
- Verify that DOS1 is enabled.
- For the ***DXL***, and triggering on L_{AVG}, verify that **AVG1** is enabled for logging ("Logging" on page 26).

Belt clip vibrator won't turn off

- The sound level may be continuously exceeding a trigger threshold. You can take action based on the significance of the trigger level, disable the trigger or reset the trigger to a higher level ("Vibrating belt clip" on page 30).

Communications not working

- Make sure that the communications interface is set to **INFRARED** ("Comm Set" on page 28).

Mic error

Microphone was removed while a study is running. The study is interrupted while ***NoisePro*** is paused.

Battery error (PFR restore)

The battery was removed while a study is running. ***NoisePro*** attempted a Power Fail Restore operation (PFR) to restore the previous run conditions.

Factory service

NoisePro and Quest field calibrator devices should be examined regularly by the factory. Quest recommends annual service.

As part of factory service, Quest checks the condition of your unit's internal battery. This battery is needed to preserve clock settings when the AA cells are replaced. It must be factory serviced.

If you have questions about ***NoisePro***'s operation or need to have it serviced, contact Quest Technologies as explained below.

- **Phone**: (262) 567-9157 or 800-245-0779
- **Fax**: (262) 567-4047
- **Internet**: www.quest-technologies.com

This contact information as well as your unit's serial number and other identifying information is given in ***NoisePro***'s Unit Info display ("To view identifying information" on page 30).

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APPENDIX

A

Glossary

Basic Descriptors

Descriptors are the terms used for measurements. ***NoisePro*** provides two types of descriptor systems: Basic and IEC/ISO. Basic descriptors are the most common measurement terms used for noise dosimetry in the United States. For information about IEC/ISO Descriptors, including a table that identifies descriptor differences, see "IEC/ISO Descriptors,"below.

Criterion Level (CL)

The Criterion Level is the maximum allowable exposure to accumulated noise. It gives the conditions that result in a 100% doses. The Criterion Level is typically set by a regulating agency, such as OSHA, and is not usually applicable for community noise monitoring.

Examples: OSHA mandates the Criterion Level (maximum allowable accumulated noise exposure) to be 90 dB for 8 hours. For an 8 hour sample, an average level (L_{AVG}) of 90 dB will result in 100% dose.

For the OSHA HEARING CONSERVATION AMENDMENT, the "action level" is 85 dB for 8 hours. This would result in a 50% dose reading. Note that the Criterion Level has not changed. (If the Criterion Level is changed to 85 dB then an 8 hour average of 85 dB would result in 100% dose.)

Criterion Time

The time over which the Criterion Level is established, generally eight hours.

Decibel (dB)

Engineers frequently are faced with the need to compare things. One way to do that is to form a ratio of their quantities. For example, a meter is 100 times the size of a centimeter—the ratio is dimensionless. Engineers commonly determine differences in power using a special unit called a decibel. The decibel is calculated as the logarithm of the power ratio. Logarithms are used because they compress the range of very large ratios so that they're easier to display together.

Dose

Related to the Criterion Level, a dose reading of 100% is the maximum allowable exposure to accumulated noise. For OSHA, 100% dose occurs for an average sound level of 90 dB over an 8 hour period (or any equivalent exposure). By using a TWA reading rather than the average sound level, the time period is no longer explicitly needed. A TWA of 90 dB is the equivalent of 100% dose. The dose will double (halve) every time the TWA increases (decreases) by the Exchange Rate.

Example: OSHA uses an Exchange Rate of 5 dB. Suppose the TWA is 100 dB. The dose would double for each 5 dB increase over the Criterion Level of 90 dB. The resulting dose is therefore 400%. If the TWA was instead equal to 80 dB then the dose would halve for each 5 dB below the Criterion Level. The resulting dose would be 25%.

When taking noise samples less that the full workday, dose is an easy number to work with because it is linear with respect to time.

Example: If a 0.5 hour sample results in 9% dose and the workday is 7.5 hours long, then the dose for the full workday would be a 135% dose (7.5 / 0.5 x 9%). This is computed making the assumption that the sampled noise will continue at the same levels for the full 7.5 hour workday.

Exceedence Levels

An Exceedence Level is the level exceeded by the measured noise level for an identified fraction of time. Exceedence Levels may be calculated for many time fractions.

Example: An L_{40} equal to 73 dB would mean that for 40% of the run time, the decibel level was higher than 73 dB.

Exchange Rate (ER)

Also known as the Doubling Rate, this figure refers to how the sound energy is averaged over time. Using the decibel scale, every time the sound energy doubles, the measured level increases by 3 dB. This is the 3 dB Exchange Rate that most of the world uses. For every increase of 3 dB in the time weighted average, the measured dose would double.

Some organizations such as OSHA in the U.S. have argued that the human ear self compensates for changing noise levels and they felt that the 3 dB Exchange Rate should be changed to more closely match the response of the human ear. OSHA currently uses a 5 dB Exchange Rate which would mean that the reported dose would double with every 5 dB increase in the time weighted average. The Exchange Rate affects the integrated reading L_{AVG}, Dose, and TWA but does not affect the instantaneous sound level.

Hearing Conservation (HC)

A sound level established as a standard by a consensus group or a regulatory agency to be used in a hearing conservation program. The Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA) provide regulatory standards for hearing conservation programs. In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) provide industrial standards for hearing conservation programs.

Hertz (Hz)

Unit of vibration frequency, numerically equal to cycles per second.

IEC/ISO Descriptors

Descriptors are the terms used for measurements. ***NoisePro*** provides two types of descriptor systems: Basic and IEC/ISO. The IEC/ISO system is commonly used for noise dosimetry in the European Union.

Basic noise descriptors are strictly abbreviations for the measurements. In the IEC/ISO noise descriptor system, shorter abbreviations are used but are augmented by codings that identify the settings for time and frequency parameters.

Table A–1 lists Basic and corresponding IEC/ISO descriptors and explains the meanings of the codings in the IEC/ISO descriptors.

Table A–1: Basic and IEC/ISO descriptors compared

Basic	IEC/ISO	Meanings of IEC/ISO indicators
SPL	$\mathbf{L_{CS}}$	Sound pressure level measured with C-weighting at slow response.
PEAK	$\mathbf{L_{Apk}}$	Peak sound pressure level with A-weighting
MAX	$\mathbf{L_{CSmx}}$	Maximum sound pressure level with C-weighting at slow response.
MIN	$\mathbf{L_{CSmn}}$	Minimum sound pressure level with C-weighting at slow response.
L_{AVG}	$\mathbf{L_{CSav}}$	Average sound pressure level with C-weighting at slow response.
EXP	$\mathbf{E_{CS}}$	Noise exposure, measured in Pascal units squared multiplied by time.

L_{AVG}

L_{AVG} is the average sound level measured over the run time. This becomes a bit confusing when thresholds are used. Any sound below the threshold is not included in this average. Remember that sound is measured in the logarithmic scale of decibels therefore the average can not be computed by simply adding the levels and dividing by the number of samples. When averaging decibels, short durations of high levels can significantly contribute to the average level.

Example: Assume the threshold is set to 80 dB and the Exchange Rate is 5 dB (the settings of OSHA's Hearing Conservation Amendment). Consider taking a one hour noise measurement in an office where the A-weighted sound level was typically between 50 dB and 70 dB. If the sound level never exceeded the 80 dB threshold during the one hour period, then the L_{AVG} would not indicate any reading at all. If 80 dB was exceeded for only a few seconds due to a telephone ringing near the instrument, then only those seconds will contribute to the L_{AVG} resulting in a level perhaps around 40 dB (notably lower than the actual levels in the environment).

L_{DN}

Representing the Day/Night sound level, this measurement is a 24-hour average sound level where 10 dB is added to all of the readings that occur between 10pm and 7am. This is primarily used in community noise regulations where there is a 10 dB "penalty" for night time noise. Typically L_{DN}'s are measured using A weighting, a 3 dB Exchange Rate, and no Threshold.

$L_{EP,d}$

Daily personal noise exposure.

L_{EQ}

The true equivalent sound level measured over the run time. The term L_{EQ} is functionally the same as L_{AVG} except that it is only used when the Exchange Rate is set to 3 dB and the threshold is set to none.

Max Level

The highest level sampled sound level during the instrument's run time allowing for the response that the unit is set for (fast or slow).

Min Level

The lowest level sampled sound level during the instrument's run time allowing for the response that the unit is set for (fast or slow).

Peak Level

Peak is the highest instantaneous sound level that the microphone detects. Unlike the Max Level, the peak is detected independently of the slow or fast response that the unit is set for.

Example: The peak circuitry is very sensitive. Test this by simply blowing across the microphone. You will notice that the peak reading may be 120 dB or greater. When taking a long term noise sample (such as a typical 8-hour workday sample for Osha compliance), the peak level is often very high. Because brushing the microphone over a shirt collar or accidentally bumping it can cause such a high reading, the user must be careful of placing too much emphasis on the reading.

Permissible Exposure Limit (PEL)

The A-weighted sound level at which exposure for a Criterion Time, typically eight hours, accumulates a 100% noise dose.

Response

Instruments that measure time-varying signals are limited in how fast they can respond to changes in the input signal. Sound dosimeters can operate with a wide variety of response times, but the industry has chosen two particular response times to standardize measurements. These are known as the Slow and Fast response times.

Slow response

OSHA, MSHA and ACGIH all require the Slow response for sound dosimetry. The standardized time constant for the Slow response is one second. When an instrument with a one second time constant measures a signal that abruptly stops, the measurement decays at the rate of 4.35 dB per second. If an instrument with a one-second time constant responds to a tone burst, the burst must last longer than 2 seconds for the measurement to reach a steady-state value (Figure A–1).

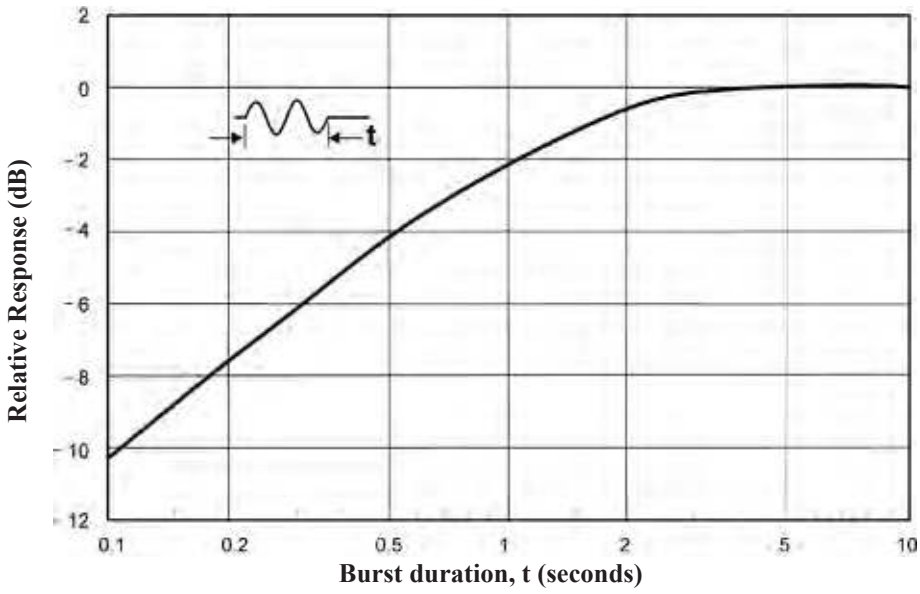

Figure A–1: Slow response to a tone burst

Fast response

NoisePro can also be set to measure using the Fast response. The standardized time constant for the Fast response is 125 milliseconds. When an instrument with a 125 ms time constant measures a signal that abruptly stops, the measurement decays at the rate of 34.7 dB per second. If an instrument with a 125 ms time constant responds to a tone burst, the burst must last longer than 500 ms for the measurement to reach a steady-state value (Figure A–2)

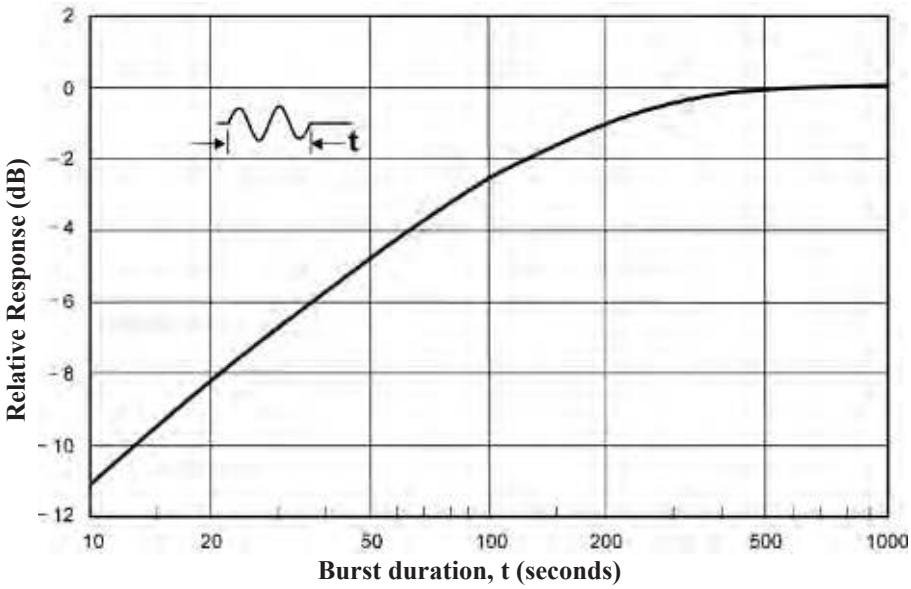

Figure A–2: Fast response to a tone burst

Sound Exposure Level (SEL)

The sound exposure level averages the sampled sound over a one second period. Assuming the sampled run time to be greater than one second, SEL is the equivalent one second noise that would be equal in energy to the noise that was sampled. SEL is typically measured using a 3 dB Exchange Rate without a threshold. (SEL is not used by OSHA).

Example: Suppose you wanted to measure in a location next to railroad tracks which also happened to be in the takeoff path of an airport. A train passes by taking 10 minutes with an average sound level of 82 dB. A jet passes overhead taking 45 seconds with an average level of 96 dB. Which of these events results in more sound energy? **Answer**: You can answer the question by comparing their SEL readings which compress each event into an equivalent one second occurrence. The SEL for the train is 109.7 dB; the SEL for the jet = 112.5 dB.

Threshold

Also known as the Cut Off, the Threshold affects the L_{AVG}, TWA, and Dose measurements. All sound below the Threshold is considered nonexisting noise for the averaging and integrating functions. The Threshold does not affect measurements in the sound level mode.

OSHA uses two different thresholds. The original Occupational Noise Exposure Standard (1971) used a 90 dB threshold and called for engineering controls to reduce the noise levels if the eight hour TWA was greater than 90 dB. The Hearing Conservation Amendment (1983) uses an 80 dB threshold and calls for a hearing conservation program to be put in place if the eight hour TWA exceeds 85 dB (50% dose). The Hearing Conservation Amendment is the more stringent of the two rulings and is what most US industrial users are concerned with.

Example: With an 80 dB threshold, suppose you placed a 79 dB calibrator on the unit for a period of time. Because all of the noise is below the threshold, there would be no average (you can think of it as an average of 0 dB). If the calibrator were 80 dB instead, then the average would be 80 dB. On histogram printouts, typically 1 minute (or other specified increment) averages are printed. Because real noise fluctuates, it is quite possible to have an average level below the threshold. This also applies for the overall L_{AVG}.

Time Weighted Average (TWA)

The Time Weighted Average represents a constant sound level lasting eight hours that would result in the equivalent sound energy as the noise that was sampled. TWA always averages the sampled sound over an 8-hour period. This average starts at zero and grows. It is less than the L_{AVG} for a duration of less than eight hours, exactly equal to the L_{AVG} at eight hours, and grows higher than L_{AVG} after eight hours.

Example: Think of TWA as having a large 8-hour container that stores sound energy. If you run a dosimeter for two hours, your L_{AVG} is the average level for those two hours - consider this a smaller 2-hour container filled with sound energy. For TWA, take the smaller 2 hour container and pour that energy into the larger 8-hour TWA container. The TWA level will be lower. Again, TWA is always based on the 8-hour container. When measuring using OSHA's guidelines, TWA is the proper number to report if the full workshift was measured.

Example: If the workshift is 6.5 hours long, then measure for the entire 6.5 hours. TWA is the correct level to report to OSHA. It does not have to be modified.

Upper Limit (UL)

This is a feature available on many of the Quest dosimeters. The user can select a certain decibel level. The dosimeter will then record the amount of time that the sound level was at or greater than the preset level. This time is then recorded as "UL TIME".

NOTE: The Upper Limit is a measurement parameter. Setting it does not affect the operating range of the instrument.

Weighting

Input sound signals are generally scaled, or weighted, so that the instrument's frequency response follows characteristic curves. There are three such standardized weighting curves in common use, and all are implemented in ***NoisePro***.

A-weighting is said to best fit the frequency response of the human ear. When a sound dosimeter is set to A-weighting, it responds to the frequency components of sound much like your ear responds. Sound dosimeters sometimes use C-weighting and Z-weighting (zero or no weighting) to make measurements. Curves showing the scaling over the range of human hearing are shown in Figure A–3.

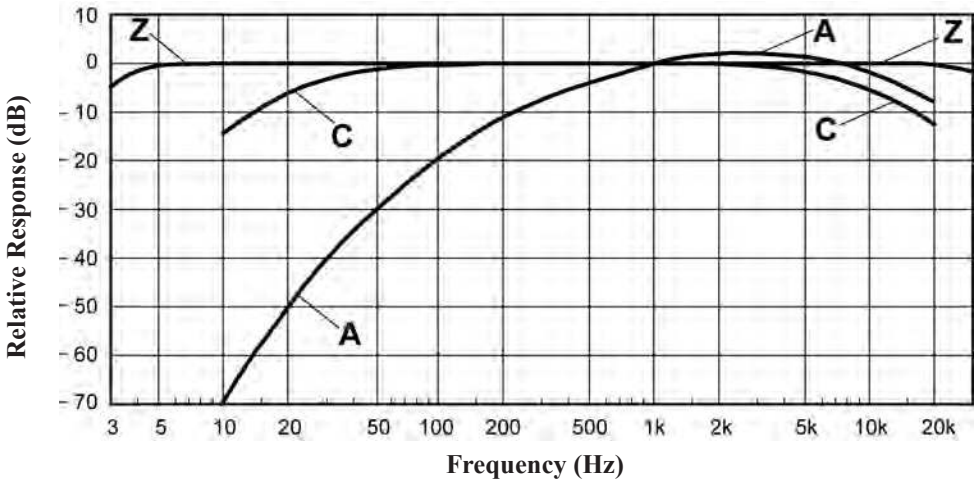

Figure A–3: NoisePro weighting curves

APPENDIX

B

Measurement equations

These equations are used in ***NoisePro*** calculations. Some of the terms used in these equations are explained in Table B–1. Others are explained in Appendix A , "Glossary."

$$DOSE = \frac{100}{\mathrm{TC}} \left[\int_0^{\mathrm{RTIME}} 2^{(\mathrm{LS}-\mathrm{CL})/(\mathrm{ER})}\ \mathrm{dt} \right] \%$$

$$PrD_{8\ hours} = \mathrm{DOSE} \times \frac{\mathrm{TC}}{\mathrm{RTIME}} \%$$

$$PrD_{x\ hours} = \mathrm{DOSE} \times \frac{\mathrm{Prt}}{\mathrm{RTIME}} \%$$

$$L_{AVG} = \mathrm{ER} \left[log_2 \int_0^{\mathrm{RTIME}} 2^{\mathrm{LS}/\mathrm{ER}}\ \mathrm{dt} - log_2\ (\mathrm{RTIME}) \right] dB$$

$$L_{EQ} = 3.01 \left[log_2 \int_0^{\mathrm{RTIME}} 2^{\mathrm{LS}/3.01}\ \mathrm{dt} - log_2\ (\mathrm{RTIME}) \right] dB$$

$$SEL = \mathrm{ER} \left[log_2 \int_0^{\mathrm{RTIME}} 2^{\mathrm{LS}/\mathrm{ER}}\ \mathrm{dt} \right] dB$$

$$TWA = \mathrm{ER}\left[log_2 \int_0^{\mathrm{RTIME}} 2^{\mathrm{LS/ER}}\,\mathrm{dt} - log_2\,(\mathrm{TC}) \right] dB$$

$$TWA_{x\ hours} = \mathrm{L_{AVG}} + \mathrm{ER}\left[log_2 \left(\frac{\mathrm{Prt}}{\mathrm{TC}}\right) \right] dB$$

$$EXP_{HRS} = [2^{(\mathrm{L_{EQ}} - 94)/3.01}]\ \frac{\mathrm{RTIME}}{3600}\ Pa^2H$$

$$LHIST = \mathrm{ER}\left[log_2 \int_0^{\mathrm{HTIME}} 2^{\mathrm{LS/ER}}\,\mathrm{dt} - log_2\,(\mathrm{HTIME}) \right] dB$$

$$TIME\ STAT\ DIST = 100 \times \frac{\mathrm{SC}}{\mathrm{TS}}\ \%$$

Table B–1: Variables used in the equations

Variables	Explanations
LS	Sound level, in decibels, that exceeds the Threshold Level. The response time is indicated by the second letter (Slow or Fast).
TC	8 Hour Criterion Time (28800 seconds).
RTIME	Run Time (seconds).
ER	Exchange Rate (3, 4, 5 or 6 dB).
CL	Criterion Level (40 to 140 dB).
LHIST	Integrated level stored either in 1 second, 10 second, or 1 minute periods based on the programmed logging setup.
HTIME	Time used to compute Time History (1 second, 10 seconds, or 1 minute).
SC	Sample Counts. The number of samples occurring at the same decibel level.
TS	Total Samples. The total number of samples during the Run Time.
Prt	Projection Time (seconds).

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APPENDIX
C

Microphone

The ***NoisePro DLX-1*** model is shipped with Class/Type 1 microphone (commonly called Class 1) that you must assemble to its cable. All other ***NoisePro*** units, including the Class/Type 2 ***DLX*** (commonly called Class 2), are equipped with an integrated microphone/cable assembly. You can also obtain a boom microphone assembly from Quest that uses the same Class 2 microphone.

Frequency response

This chapter contains frequency response curves for the Class 1 microphone, the cable-mounted Class 2 microphone and the boom-mounted Class 2 microphone. Results are given under free field conditions at microphone orientations of 0^o and 90^o with respect to the sound source. Results are also given under random incidence conditions, both with and without the appropriate microphone windscreen attached.

Class 1 microphone

Response curves for the BK4936 Class/Type 1 microphone (Quest No. 059-523). Testing was done using the standard cable (Quest No. 053-877) and with the microphone suspended on strings in a free field test facility.

NOTE: For these measurements, the Random Incidence Corrector was not attached to the microphone. See the information supplied with the Class 1 microphone for response characteristics that include the effects of this corrector.

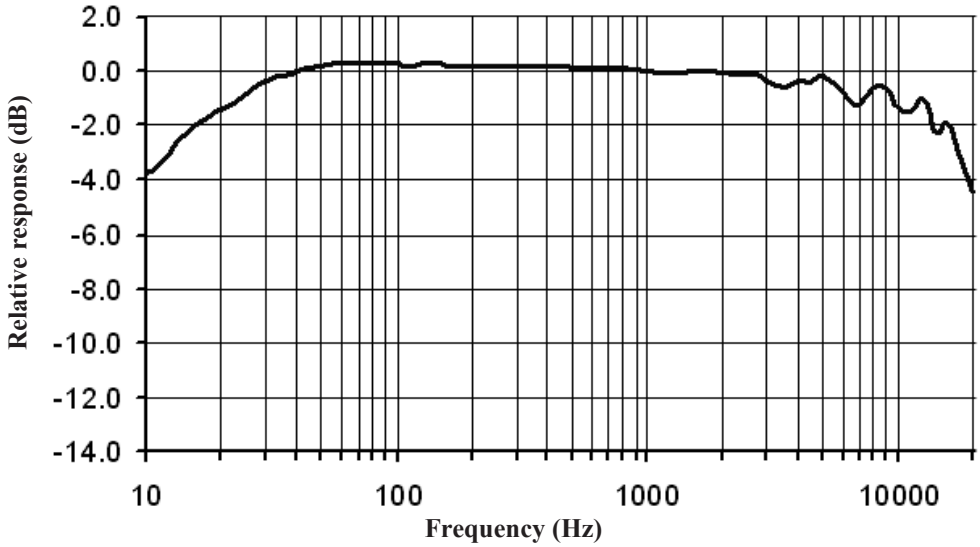

Figure C–1: Class 1, free field, 0°, no windscreen

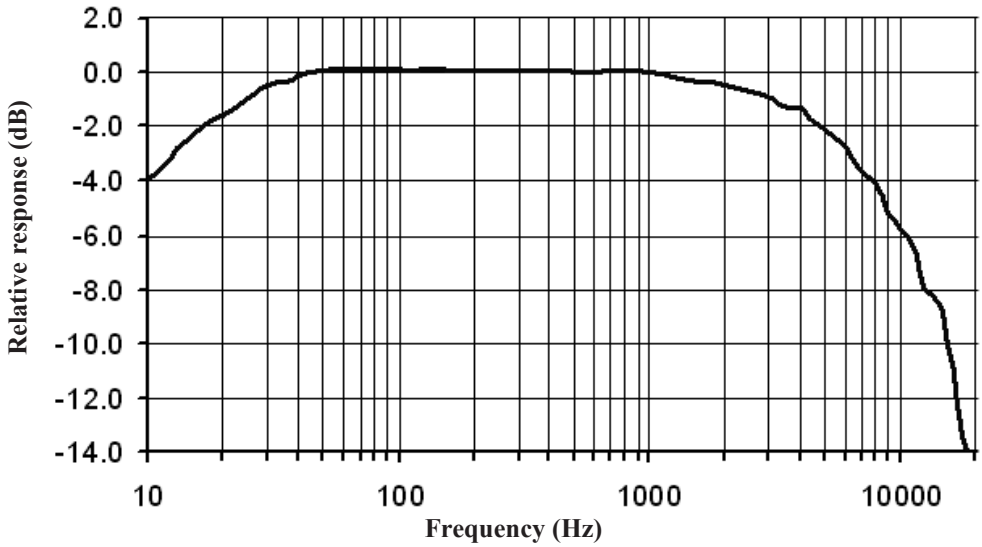

Figure C–2: Class 1, free field, 90°, no windscreen

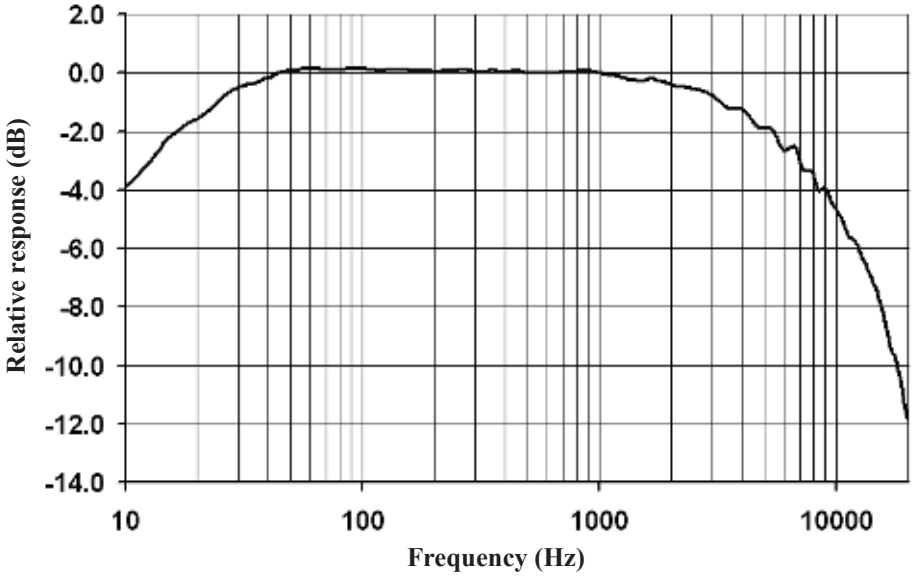

Figure C–3: Class 1, random incidence, no windscreen

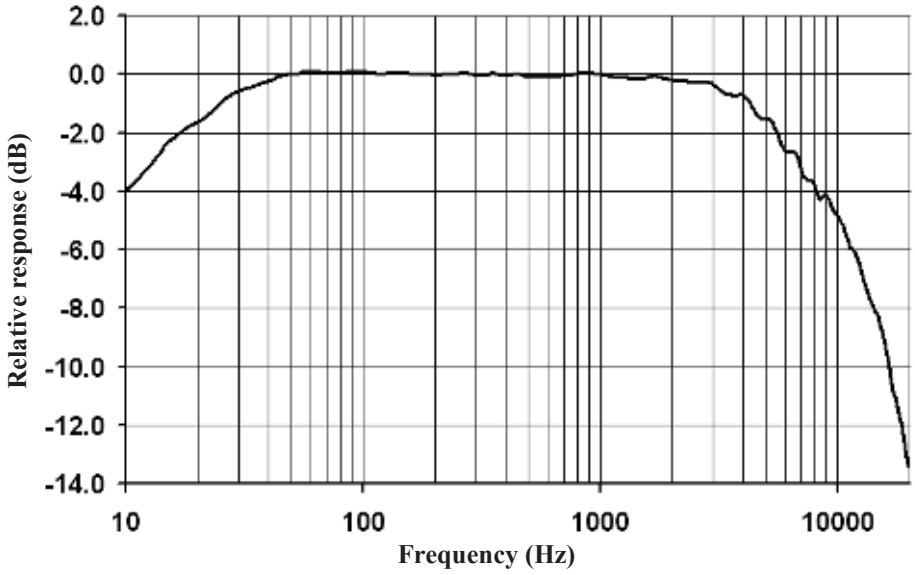

Figure C–4: Class 1, random incidence, windscreen

Class 2, cable-mounted microphone

Response curves for the Class/Type 2 microphone and cable assembly (Quest No. 053-867). Testing was done with the microphone suspended on strings in a free field test facility.

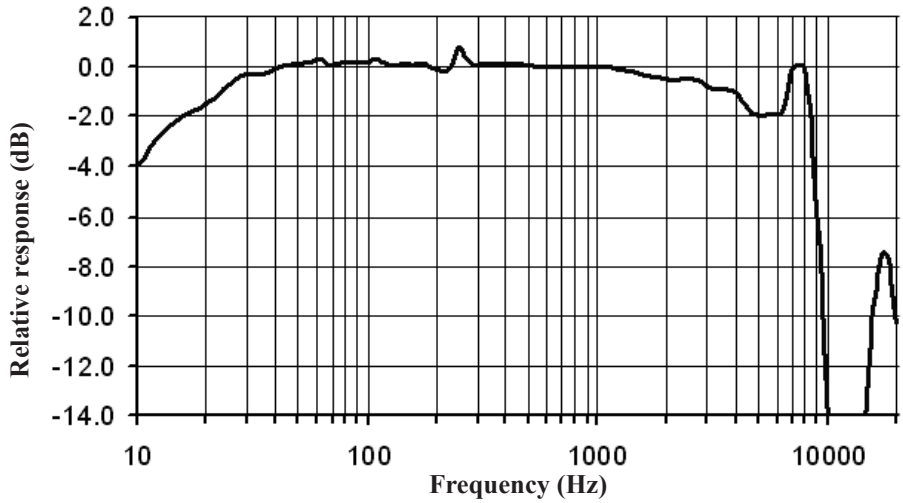

Figure C–5: Class 2, free field, 0°, no windscreen

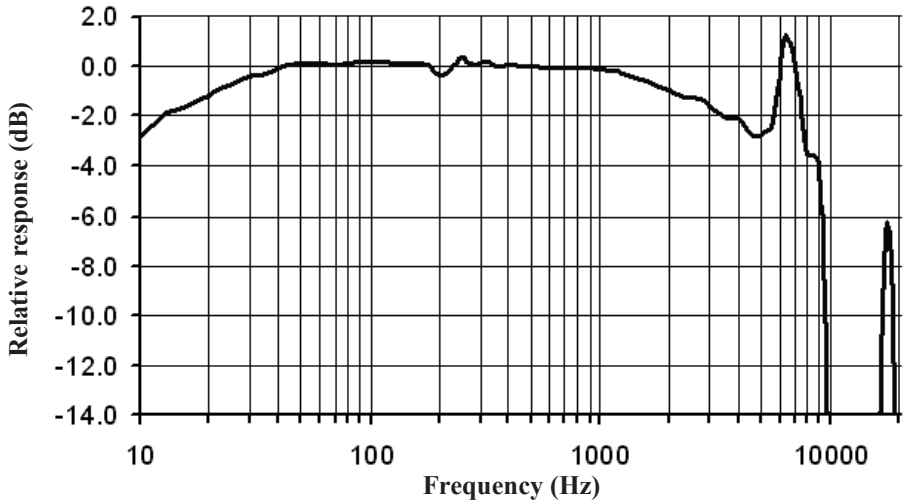

Figure C–6: Class 2, free field, 90°, no windscreen

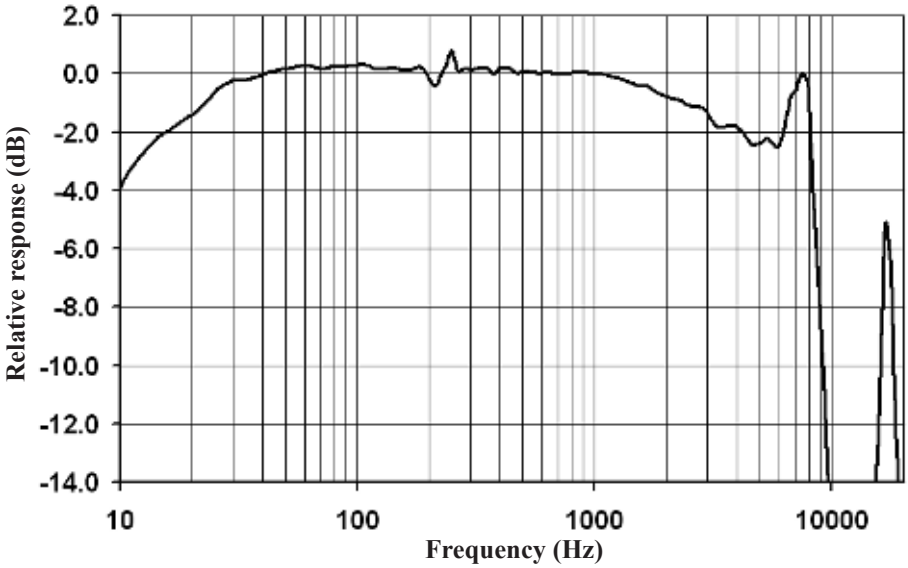

Figure C–7: Class 2, random incidence, no windscreen

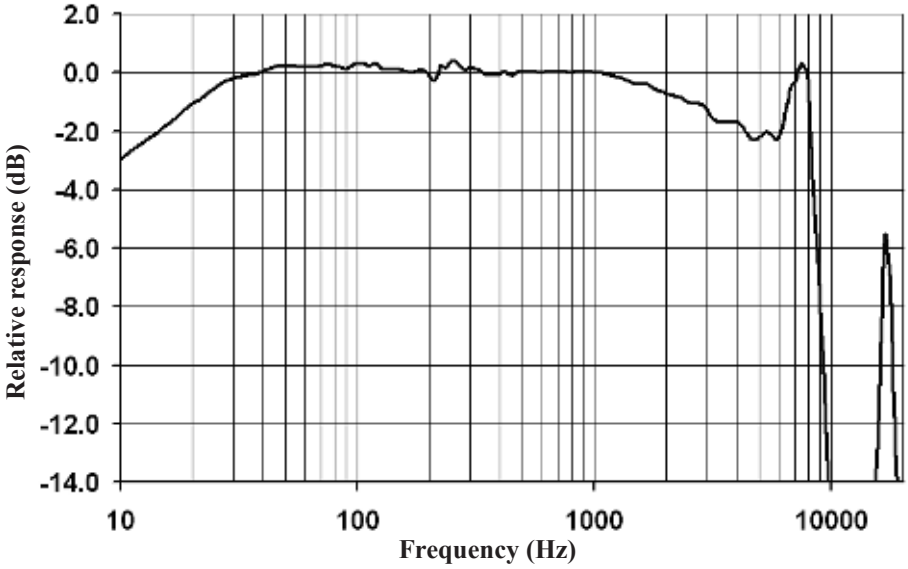

Figure C–8: Class 2, random incidence, windscreen

Class 2, boom-mounted microphone

Response curves for the Class/Type 2 microphone and boom assembly (Quest No. 053-885). Case reflections and diffractions are included in the measurements.

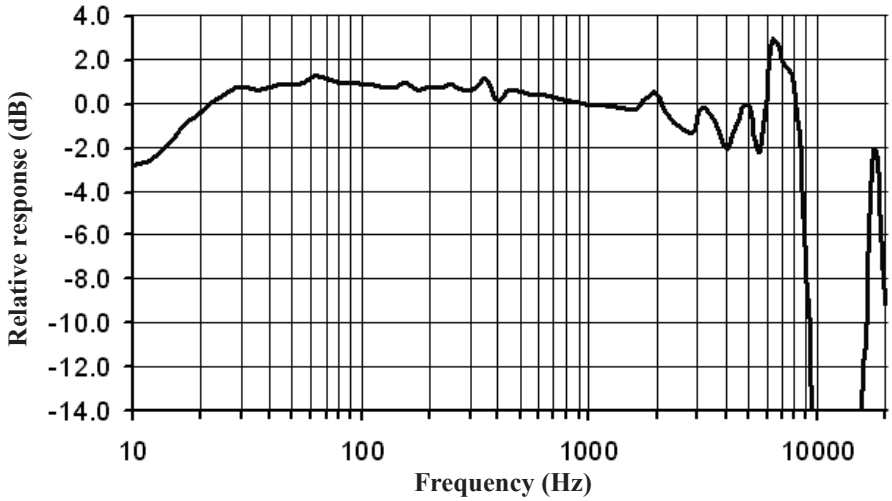

Figure C–9: Class 2, boom, free field, 0°, no windscreen

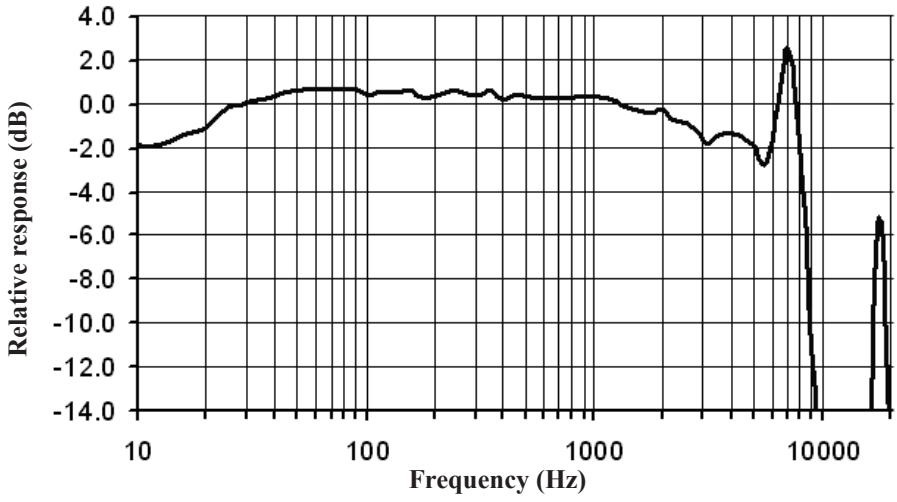

Figure C–10: Class 2, boom, free field, 90°, no windscreen

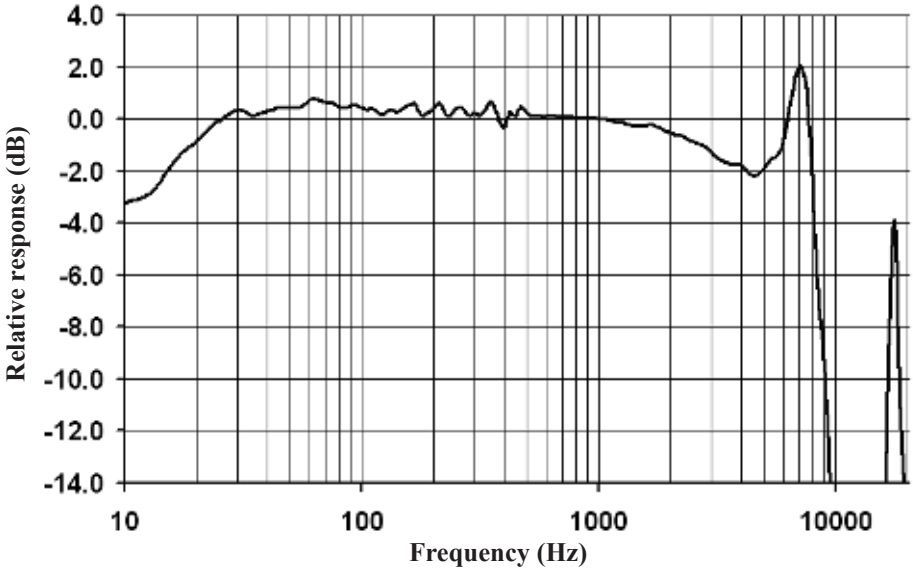

Figure C–11: Class 2, boom, random incidence, no windscreen

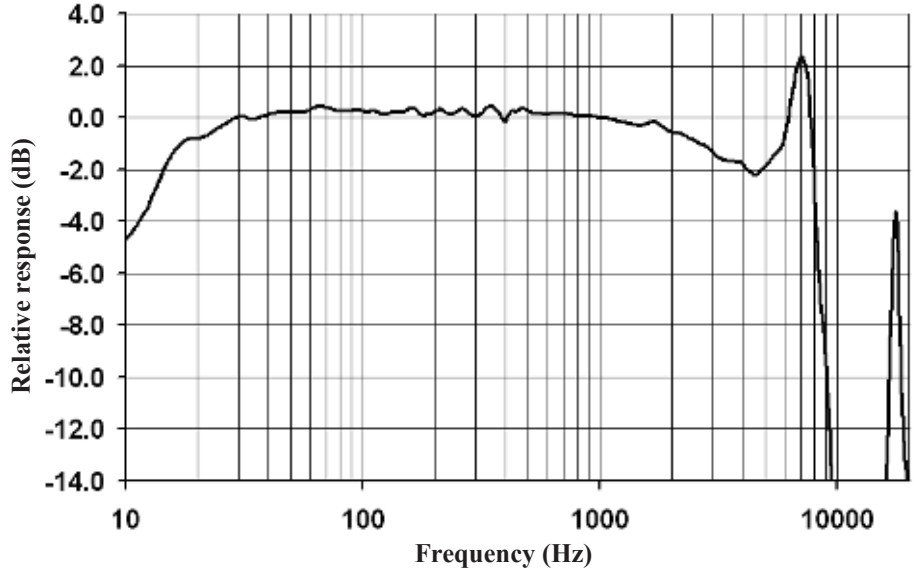

Figure C–12: Class 2, boom, random incidence, windscreen

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APPENDIX

D

Specifications

All specifications subject to change.

Standards

- ANSI S1.25 - 1991, ANSI S1.4 - 1983: Class/Type 2, Class/Type 1 (***DLX-1*** only)
- IEC 651 - 1979: Class/Type 2, Class/Type 1 (***DLX-1*** only)
- IEC 804 - 1985: Class/Type 2, Class/Type 1 (***DLX-1*** only)
- IEC 1252 - 1993

User interface

- **Display**: Backlit 128 x 64 pixel LCD. Several options for backlighting occurrence plus continuously-adjustable contrast settings.
- **Keypad**: Membrane switches for environmental isolation, including four softkeys with variable functions that depend upon the display.
- **Languages**: English, French, German, Spanish and Italian.
- **Data descriptors**: Choice of Basic (US) or IEC/ISO.

Measurement Ranges

- **RMS**: Two ranges, 40 – 110 dB and 70 – 140 dB, each of which covers a 70 dB dynamic range. All dosimeters are set to the same range. Maximum level is for sinusoidal signals. A signal with a 10 dB crest factor will be measured accurately if its rms level is 10 dB below the maximum level for the range.
- **Peak**: 115 – 143 dB, covering a 28 dB dynamic range.

Measurement settings

- **Dosimeters**: Up to two dosimeters at once, each with its own assignable profile. (***NoisePro DLX*** models have two additional dosimeters.)
- **Dosimeter profiles**: Nine saved setups, five of which are pre-configured to comply with OSHA, MSHA and ACGIH noise dosimetry standards and cannot be changed. One other setup is pre-figured to comply with the 2003/10/EC

Directive of the European Union and can be changed to accommodate member country deviances. Three other setups are user-configured.

- **Response**: Slow, Fast or Impulse for any user-configured dosimeter. Impulse must be for all or for none.
- **Exchange Rate**: 3, 4, 5 or 6 dB for any user-configured dosimeter.
- **Criterion Level**: 40 – 140 dB in 1 dB increments for any user-configured dosimeter.
- **Criterion Time**: 1 – 18 hours in 1-hour increments per dosimeter for any user-configured dosimeter.
- **Threshold**: Either Off or set in the range, 40 – 140 dB (1 dB increments), for any user-configured dosimeter.
- **Upper Limit**: 40 – 140 dB for any user-configured dosimeter.
- **Frequency weighting**: All dosimeters have the same RMS and Peak weighting settings.
  - **RMS**: A-weighting or C-weighting
  - **Peak**: A-weighting, C-weighting or Z-weighting.
- **Projected Time**: 1 to 18 hours in 1-hour increments. All dosimeters are set to the same projected time.

Measurement resolution

- **Amplitude**: 0.1 dB.
- **Dose**: 0.001% to 9999%. Auto-scaling always shows 4 digits.
- **Statistical Distribution**: 0.1 dB increments for Slow or Fast.

Calibrations

- **Weighting**: Values obtained at current weighting setting.
- **History**: Latest pre-calibration (before session) and post-calibration (during session) values saved with an associated study and can be displayed.

Logging (*DL* and *DLX* models only)

- **Configuration**
  - ***DLX***: Choices available for all settings.
  - ***DL***: All settings are fixed and unalterable.
- **L_{AVG}/L_{EQ}**: Logged per dosimeter.
- **Max levels**: Slow, Fast or both.
- **Peak level** (***DLX*** only)
- **Min levels**
  - ***DLX***: Slow, Fast or both.
  - ***DL***: Not available.
- **Time above ceilings**
  - ***DLX***: Separate Slow and Fast ceiling thresholds, adjustable over 40 – 140 dB.
  - ***DL***: Not available.
- **Logging interval**
  - ***DLX***: 1 second to 1 minute, in 10 steps (1 minute only for the ***DL***).
  - ***DL***: 1 minute only.

Communications

NoisePro can communicate via infrared transmission with a separate computer at a data rate at 115200 baud. Use this communications channel for printing and to interact with ***QuestSuite Professional***. You can also shuttle session data from any other ***NoisePro*** unit to a ***NoisePro DLX***.

Special functions

- **Security**: Independent password protection for run/pause controls and setup.
- **Auto-Run**: Pre-program to run automatically up to twice weekly, up to four scheduled dates or end after a specified run time.

Environmental factors

- **Operating temperature**: +14 ^{O}F to +122 ^{O}F (–10 ^{O}C to +50 ^{O}C).
- **Storage temperature**: –13^{O}F to +140 ^{O}F (–25 ^{O}C to +60 ^{O}C).
- **Humidity**: 0 to 95% non-condensing.
- **Electromagnetic field effects**: Negligible below 50 Oersteds at 50 to 60 Hz. Tested for RF succeptibility with <1dB error at field strengths to 10 V/m over the frequency range of 10 MHz to 500 MHz.

Electrical characteristics

- **Microphones**:
  - **Class/Type 1 (DLX-1 only)**: 0.52 in. (12.2 mm), free field.
  - **Class/Type 2 (all other models)**: 0.335 in. (8.5 mm), random incidence.
- **Memory:** Data and settings stored in nonvolatile memory.
- **Detector**: True rms, 63 dB pulse range.
- **Channels**: One rms channel and one peak channel.
- **Integration time**: With a 3 dB Exchange Rate and a signal level of 140 dB the integration time would be one year or longer. Integration time is longer as the signal level decreases and the Exchange Rate increases.
- **Date and time**: Time resolved by seconds; 12-hour or 24-hour clock.
- **Power needs**:
  - Two 1.5-volt, AA, replaceable alkaline cells. Select as specified under “Approved batteries” on page 65.
  - Long-life Lithium battery to maintain time and date settings during battery replacement.
- **Battery lifetime**: The replaceable alkaline batteries have a lifetime of approximately 60 hours when neither the display backlighting nor the optional vibrating belt clip is used. If you select one of the backlighting options or are triggering vibrator alerts, battery lifetime can be substantially decreased.

Mechanical characteristics

- **Dimensions**: 5 in. x 2.7 in. x 1.5 in. (127 mm x 68.6 mm x 38.1 mm).
- **Weight**: 14 oz (369 g).
- **Construction**: Industrial-grade cast aluminum, IP-65 rated case. Security cover held in place by a slotted screw.

Approvals

- **Intrinsic Safety**: UL, cUL, MSHA, Ex and ATEX.
- **Intrinsic Safety (pending)**: SIMTARS.
- **Product standards**: CE Mark, EN 61252, ANSI S1.25.

Replacement Parts

059-523	**Class/Type 1 microphone (*DLX-1*)**: BK4936 microphone, 0.52 inch (12.2 mm), furnished with Random Incidence Corrector.
053-877	**Cable for Class/Type 1 microphone (*DLX-1*)**: Cable has integrated preamp and shoulder attachment clip at one end and LEMO connector at other end.
053-867	**Class/Type 2 microphone assembly (all but *DLX-1*)**: Cable with the microphone and shoulder attachment clip at one end and LEMO connector at other end. Microphone size: 0.335 inch (8.5 mm).
059-344	**Windscreen**: WS-7, for 0.52 inch (12.2 mm) Class 1 microphone. Package of 3.
053-384	**Windscreen**: WS-5, for 0.335 inch (8.5 mm) Class 2 microphone. Package of 10.

Optional accessories

Adapter

053-810	Serial-to-USB adapter
053-857	Infrared serial adapter

Calibrators

056-981	**Calibrator**: QC-10. 114 dB at 1000 Hz
056-982	**Calibrator**: QC-20, selectable 94 dB or 114 dB at 250 Hz or 1000 Hz
056-990	**Adapter**: For QC-series calibrators and Class 1 microphone, 1 inch O.D. (25.4 mm) and 0.52 inch I.D. (12.2 mm)
053-884	**Adapter**: For QC-series calibrators and Class 2 microphone, 1 inch O.D. (25.4 mm) and 0.335 inch I.D. (8.5 mm)

Tripods

59-045	TP-1 tripod (height range: 18.5 inch - 48.9 inch)
59-046	TP-2 tripod (height range: 14.6 inch - 43.5 inch)

Other

053-885	**Boom microphone**: For use with Class 2 models (not ***DLX-1***). Includes the same microphone mounted on a rigid boom that attaches to the instrument's LEMO connector.
053-862	**Belt clip**: Contains a vibrating motor.
056-830	**Clips**: Clothing clips to attach microphone cable. Kit of 5.

APPENDIX

E

Block diagram

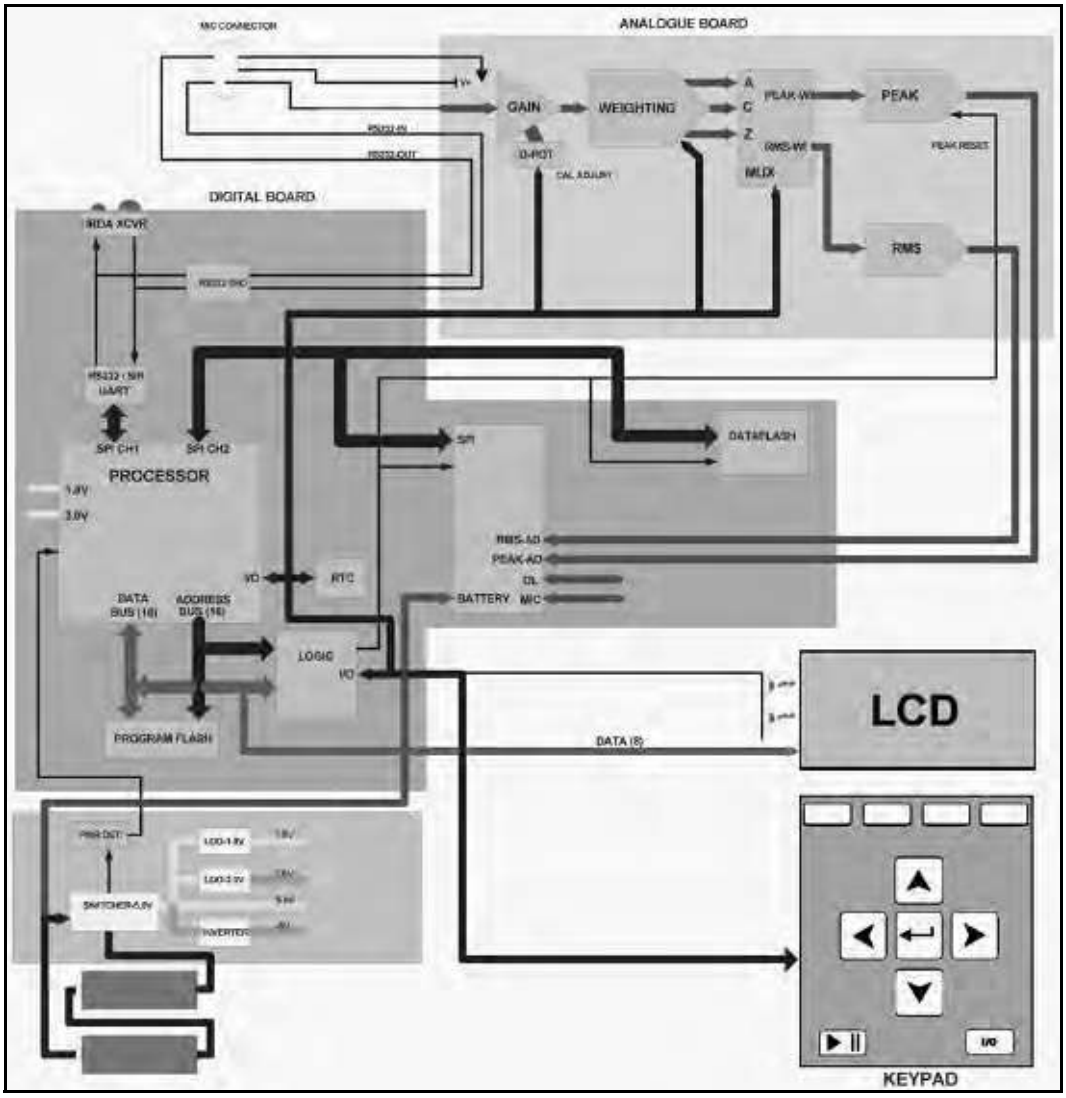

Figure E–1: NoisePro block diagram

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APPENDIX

F

Quest policies

Contacting Quest Technologies

Should your Quest Technologies equipment need to be returned for repair or for recalibration, please contact the service department at the following number or access the online form via the website. For technical issues, please contact Technical Support.

Service Department and **Technical Support**: 1 (800) 245-0779. Fax: 1 (262) 567-4047. Office hours are 8:00 a.m. to 5:00 p.m. United States Central.

- **E-mail** at quest.mail@mmm.com
- **Internet** at www.questtechnologies.com

International customers

Contact your local, factory-authorized distributor from whom the product was purchased. You can obtain the name and contact information of your local factory-authorized distributor from Quest by using the e-mail, telephone, or fax information given under "Contacting Quest Technologies" above.

Warranty

Quest Technologies warrants our instruments to be free from defects in materials and workmanship for one year under normal conditions of use and service. For United States customers, we will replace or repair (our option) defective instruments at no charge, excluding batteries, abuse, misuse, alterations, physical damage, or instruments previously repaired by other than Quest Technologies. Microphones, sensors, printers, and chart recorders may have shorter or longer warranty periods. This warranty states our total obligation in place of any other warranties expressed or implied. Our warranty does not include any liability or obligation directly resulting from any defective instrument or product or any associated damages, injuries, or property loss, including loss of use or measurement data.

For warranty outside the United States, a minimum of one year warranty applies subject to the same limitation and exceptions as above with service provided or arranged through the authorized Quest distributor or our Quest European Service Laboratory. Foreign purchasers should contact the local Quest authorized sales agent for details.

A

Accuracy 63
ACGIH
  Alert Level 45
  Dosimeter setups 33
  Profile settings 34
  Standards organization 1
Alert Levels, explained 45
Auto-Run 20–24
  Date mode 21
  Days of Week mode 23
  Enable/disable 24
  Timed Run mode 22
Average sound level (LAVG) 76
A-weighting, defined 81

B

Background noise, removal 61
Backlighting setup 29
Basic Descriptors 30
Batteries
  Lifetime 98
  Lobat indicator 9
  Replacement 65
Battery icon 9
Belt clip, install 67
Boom microphone
  Connecting 8

C

Calendar . . . . . 20 *Note*
Calibration
  Procedures 15–18
  Troubleshooting 69
Calibrator 15
Clock, setup 25
Close Session 14
Closed Session icon 13
Code, recovery . . . . . 49 *Note*, 49 *Note*
Combining levels, adding 62
Comm display 53
Communication, troubleshooting 70
Compliance indicators 45
Conflicts, resolution 38
Cover, case 4
Criterion Level, defined 73
Criterion Time, defined 73
Cut Off
  See “Threshold”
C-weighting, defined 81

D

Data Results display 41
Date
  365-day limit . . . . . 20 *Note*
  AutoRun Mode 22
  Setup display 25
Date mode, Auto-Run 21
Day/Night sound level (LDN) 77
Days of Week, Auto-Run 23
Decibel, defined 73
Descriptors
  Basic defined 73
  Data Results display 42
  Defined 73
  Display Menu 30
  IEC/ISO explained 75
Display, backlighting 29
DL, logging report 60
DLX models
  Closing a session 14
  Logging report 60
DLX-1
  Microphone assembly 7
  Microphone response 87, 88
Dose

Defined 74
Equations 83
Dosimeter
Data Results display 42
Disable vibration . . . . . 30 *Note*
Dosimeter setups
Conflict resolution 38
Definition 33
User setups 34
Dynamic range, defined 1

E

E-mail Quest 30
Equations 83
Equivalent sound level (LEQ) 77
Escape key 9
EU
Change setup 36, 37
Directive 33
Exceedance
Defined 74
Exchange Rate (ER)
Defined 74
Exposure
Daily personal (LEP,D) 77
Equation 84
Indicators 76

F

Fast Ceiling (FCEIL) 26
Fast response, curve 79
Formulas 83

H

Header, reports 57
Hearing Conservation (HC)
1983 Amendment 80
Dosimeter setups values 33
Program definition 75
Hertz (Hz), defined 75

I

IEC/ISO descriptors 30
Infrared
Comm Set display 28
Hardware setup 51
Troubleshooting 70
Interval, logging 26

L

LAVG
Defined 76
Equation 83
LDN, defined 77
LEQ
Defined 77
Equation 83
Lobat
Battery replacement 65
Indicator 9
Lock
Locked Run display 48
Softkey 47
Logging
Ceiling settings 26
Interval 26
Introduction 2
Report 60
Setup menu 26

M

Max Level, defined 77
Microphone
Class 1, response 87
Class 2 boom, response 92
Class 2 cable, response 90
Class 2 connection 8
Frequency response 87
Mounting 12
Position, dosimetry 11
Position, SLM measurements 12
Response, Class 1 88–89

Response, Class 2 90–93
Min Level, Defined 77
MSHA
Alert Level 45
Dosimeter setups 33
Profile settings 34
Standards organization 1

N

Noise floor 63

O

OSHA
Alert Level 45
Dosimeter setups 33
Profile settings 34
Standards organization 1
Threshold standards 80
TWA 80
Overload
Indicator 43
Session Report 58
Study Report 59

P

Pause icon 13
Peak level, defined 77
Permissible Exposure Limit (PEL)
Defined 78
Dosimeter setups 33
Personal monitoring, mounting 12
Power
On/Off 9
Troubleshooting 69
Printing
Hardware setup 51
Print display 54
Projected Time (PRJ), setup 25

Q

Quest website 30

R

Random Incidence Corrector
Applying it 7
Using it 12
Range
Changing 37
Conflict resolution 38
Recovery Code
Secure Run Mode . . . . . .49 *Note*
Secure Setup Mode . . . . . .49 *Note*
Reports
Controlling contents 54
Header section 57
Session section 58
Study section 59
Reset
Clears results . . . . . .39 *Note*
How to 11
Response
Conflict resolution 38
Data Results display 42
Definitions 78
Results
Review previous 40
Summary display 44
View current 39
RTIME
See “Run Time”
Run icon 13
Run Time
Data Results display 42
Defined 4

S

Secure Run Mode 47–48
After shut down . . . . . .47 *Note*
Disable 48
Enable 47
Locked Run display 48
Recovery Code . . . . . .49 *Note*
Start study in 48

Secure Setup Mode
Disable 49
Recovery Code . . . . . 49 *Note*
Secure Setup Mode, Shutdown . . . . . 49 *Note*
Serial number 30
Session
Closing DLX session 14
Introduced 2
Report 58
Run Time 4
Session counter, increment 14
Setup, dosimeter
See "Dosimeter setups"
Shuttle
Introduction 51
Procedure 54
Slow Ceiling (SCEIL) 26
Slow response, curve 78
Sound Exposure Level (SEL)
Defined 79
Equation 84
Sound Level Meter
Microphone position 12
SPL measurement 44
Study
Report 59
Secure Run Mode 48
Summary results 44

T

Threshold, defined 80
Time Weighted Average (TWA)
Defined 80
Equations 84
Time, setup 25
Timed Run, Auto-Run 22
Trigger
Enable, vibration 31
Vibration 31
Tripod, using 12

U

Upper Limit, defined 81
USB 51
User settings, lock 49
User setups
Compliance indicators 45
Dosimeter setups 34

V

Validity 63
Vibration
Belt clip installation 67
Enable trigger 31
Rate 30
Trigger setup 31
Troubleshooting 70
View current data 39

W

Website, Quest 30
Weighting
Changing 37
Conflict resolution 38
Conflicts 38
Defined 81
Windscreen
Effect on frequency response 87
Using 11

Z

Z-weighting, defined 81

Quest Technologies, a 3M company, is a world class manufacturer and leader in the field of occupational safety, industrial hygiene and environmental instrumentation. Quest products are used in more than 80 countries worldwide. Quest has a strong reputation of rugged, reliable instrumentation and software systems that monitor and evaluate occupational and environmental health and safety hazards including noise, vibration, heat stress, indoor air quality and toxic/combustible gases.

Quest monitoring instruments serve a variety of occupations and industries with clients in mining, research, enforcement, military, education, insurance and manufacturing business sectors.

- Visit www.questtechnologies.com for further information.

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